Nuestra Familia Sana
Genomics Educator Program

Train the Trainer Manual

Nuestra Familia Sana

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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INTRODUCTION

The *Nuestra Familia Sana* Genomics Educator Program (Our Healthy Family) is a community model of informal genomic learning that is culturally and linguistically appropriate for low-literacy Latinx adults. It was developed and implemented by a research team at Wake Forest University School of Medicine (WFUSM) with expertise in genomics and public health education. To engage learners who may have little knowledge or interest in genetic and genomics, we paired information about concrete strategies to keep families healthy by reducing environmental exposures with genetic and genomic content. Latinx adults have high interest in topics that will improve their families' well-being. Therefore, we used that interest as a hook to encourage their participation in a set of learning opportunities about a STEM topic that many people without a strong science background find intimidating. Latinx community members provided the learning sessions in people's homes or at local, trusted community organizations to further reduce intimidation.

Latinx adults in the United States (US) are often underrepresented in informal STEM learning opportunities. Access to such opportunities is particularly limited for Latinx immigrant adults who have limited formal education and lack English fluency. In the US, 55% and 47% of adult immigrants from Mexico and Central America respectively have less than a ninth grade education; 26% have a high school education (both regions); and 17% and 8% respectively, have a college education.[1, 2] More Latinx individuals were born in the US than before, driving up English proficiency among teens and young adults (76%), but only around 55% of Latinx ages 34 to 49 report speaking English "very well."[3] In addition to potential language barriers and limited formal education, many Latinx immigrant adults in the US face additional challenges for engaging in informal learning, including limited financial resources, lack of documentation, transportation, perception that the programs or organizations such as museums are not for people like them, and lack perception of themselves as science learners.[4, 5]

Tailored informal education is therefore needed to break through barriers and engage Spanish-speaking Latinx adults who lack English fluency and who may have limited Spanish literacy in informal STEM learning programs. STEM concepts should be presented in a culturally and linguistically appropriate manner to lessen intimidation and increase interest. The focus of this genomics educational program is to engage the Spanish-speaking Latinx community members in informal learning opportunities that address genomic concepts. The number of Latinx who may benefit from learning about basic genomics is substantial.

For this project, we modified a strategy that has been used in a different arena. Lay health educators, or educators, are recognized as an effective means to deliver health information and health services to Latinx. They have been found to be an effective way to extend existing health service delivery and to provide culturally competent services for minority, immigrant, and marginalized populations that have particular needs.[6, 7] This project uses strategies similar to those used by lay health educators, but in the context of informal STEM learning. Lay Community Educators (LCEs) have knowledge about their community, have existing social connections, and minimize trust barriers. The motivation for developing this LCE led education program was to develop a strategy and specific materials for engaging adult immigrants from Mexico and Central America in informal STEM learning about genetics and genomics. This

required that the content be not only scientifically correct, but that it be developed and presented in a way that is culturally and linguistically appropriate for the target population in a context that is not intimidating. The team used an existing community-based participatory research (CBPR) partnership to develop, implement, and refine the materials. Experiences, knowledge, and partnerships from previous studies helped shape this program.

This program is designed for educators to engage with learners during 3 to 5 sessions. The lesson plans are presented in order, but more than one can be addressed in a single session. These sessions may occur at the participants' home, at small gatherings at the homes of others, community places, or your facilities. The delivery method of this program can be modified to suit your organization's needs. Multiple visits play a vital role in learning and helps the educator establish a personal relationship with the learner. Using multiple visits allows the learner to ask questions that may arise about the informal learning content. This type of "personalismo" is an established component of Latin American cultures. For the most success, the training should be implemented in the order it is presented given that the STEM content of later sessions builds upon information and concepts presented in prior sessions.

If your organization offers this program through the use of LCEs, they do not need to have a background in teaching or STEM. Good LECs will be those who are leaders and trusted members of their communities, have the ability to communicate effectively, have willingness to learn and teach, and have enthusiasm. All the necessary information for training the educators is included in this manual.

This manual was developed to serve as a guide for the trainers and directors of informal science and genomics education programs. The information in this manual illustrates an effective training for the *Nuestra Familia Sana* curriculum. The manual is separated into different sections that include information about the program, activities, and learning materials that can be easily reproduced and modified to fit your organization's specific needs. The educator training is intended to prepare a person who is part of the Latinx community to work with Spanish speaking learners. The educators will be trained using the training manual, flipcharts, and interactive activities in addition to the presentation of the lessons. This training will include information on what the educators' duties are, content about environmental factors and how they can influence health, basic genetic and genomic content, administrative procedures, and effective ways to present information to learners in any setting. At the end of the training, the educators should be given the opportunity to practice how to be an effective educator and leader of their community. To train the educators effectively it is recommended that you:

- Be familiar with all the content and purpose of the program before the training session.
- Make necessary changes to the documents.
- Print and organize training materials.
- Encourage participation of all the educators.

An Educator Training Manual was developed for the educator to use while in training and includes background information on the project design and goals, and background information on genomics and environmental exposures. It defines the role and responsibilities of an educator and includes information on appropriate educational methods for an adult audience, particularly one in which many of the adults will have limited literacy.

Each section of this Train the Trainer Manual contains learning objectives for the educators, notes to guide the facilitator, procedures to engage the learners with the materials and content, and the content of the Educator Training Manual. Excerpts from the Educator Training Manual are enclosed in text boxes. The procedures outline how the information will be shared with LCEs. Trainers should be familiar with the content of the manual to be able to deliver the information accurately, professionally, and comfortably. This manual covers a lot of information. The educator training should take place over a series of days to allow educators to reflect on the information and practice teaching. Below is an example for a timeline for a training program:

Session 1: The first training session could cover sections 1-2.

Session 2: This session could cover the genetics and environmental exposure content in section 3 and 4.

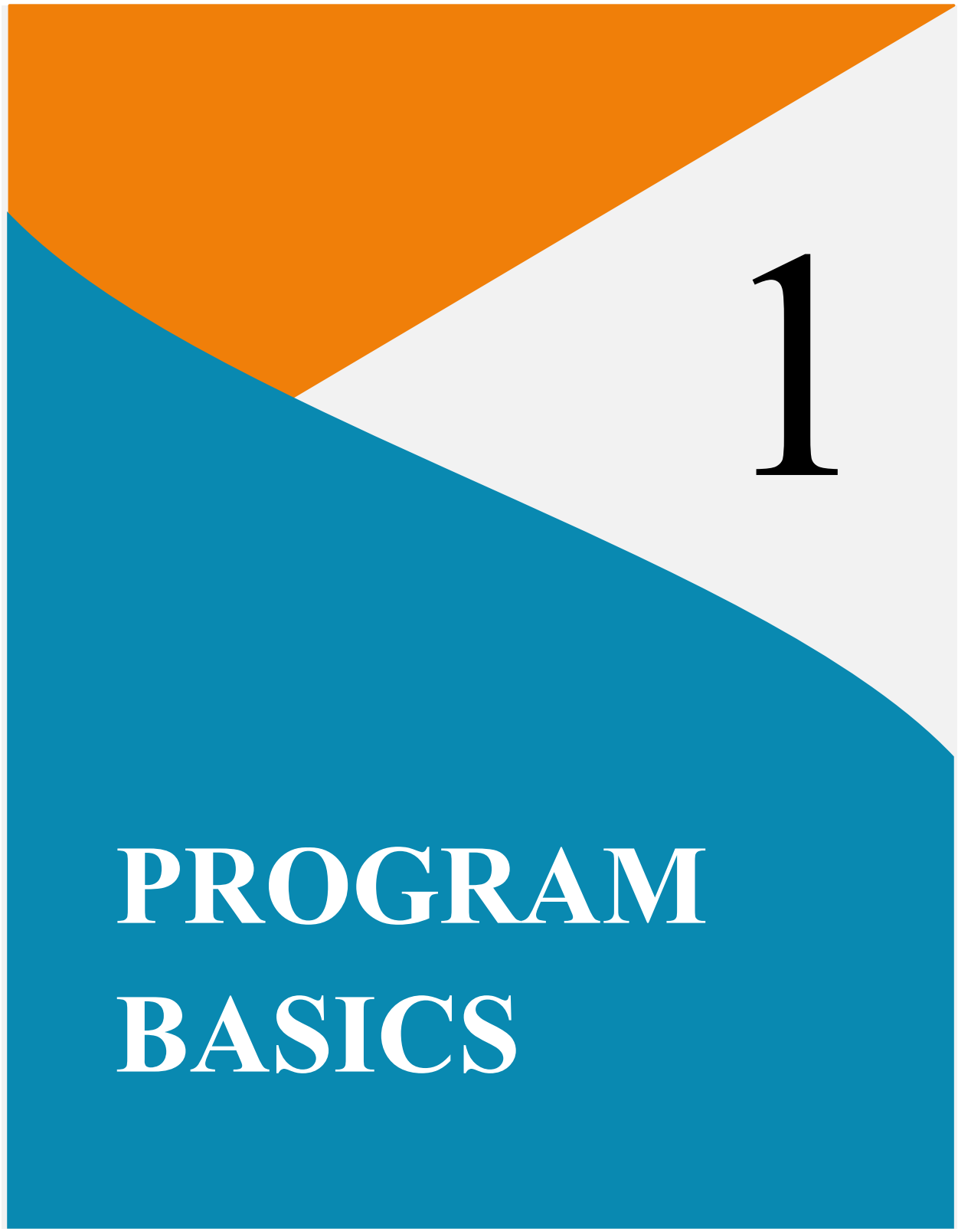
Session 3: This session will cover sections 5 and 6 and educators can practice teaching lesson(s).

All of the materials are available in both English and Spanish, with the exception of the videos, which are in Spanish. Spanish videos with English subtitles are also available. Materials for each lesson include an animated video, an Educator Manual, lesson plan, hands-on activities, a teaching flipchart, and learners handouts. However, your organization may modify content of the program to better fit your setting, needs, and goals. Please note that some sections of this document and the Educator Training Manual will need to be edited to personalize them to your organization. This manual is formatted to be printed in a double-sided format and its pages read as a book (or added to a binder); therefore, there are many pages left blank purposefully.

You can find the recommended content for the educator's toolbox in Appendix 14. We also recommend that you prepare information packets to give to learners that include all of the lesson printouts (https://school.wakehealth.edu/departments/family-and-community-medicine/nuestra-familia-sana) and any additional environmental infographics that your organization choses. There is a list of recommended infographics in Appendix 15. These packets are useful in helping learners further promote concepts learned to other people in the community. In addition, Appendices 1-12 have recommendations for hands-on-activity items to be made/created or purchased for each lesson.

References

1. Budiman A. Key findings about U.S. immigrants. Pew Research Center, Washington, D.C. [Internet] 2020 Aug 20. [cited 2022 Feb 01]. Available from: https://www.pewresearch.org/fact-tank/2020/08/20/key-findings-about-u-s-immigrants/
2. Noe- Bustamante L. Education levels of recent Latino immigrants in the U.S. reached new highs as of 2018. Pew Research Center, Washington, D.C. [Internet] 2020 April 7. [cited 2022 Feb 02]. Available from: https://www.pewresearch.org/fact-tank/2020/04/07/education-levels-of-recent-latino-immigrants-in-the-u-s-reached-new-highs-as-of-2018/
3. Krogstad JM. Rise in English proficiency among U.S. Hispanics is driven by the young. 2016. Washington, D.C.: Pew Research Center;2013.
4. Sacco K, Falk JH, Bell J. Informal Science Education: Lifelong, Life-Wide, Life-Deep. Plos Biology. Nov 2014;12(11).
5. Stein JK, Garibay C, Wilson KE. Engaging immigrant audiences in museums. Museums & Social Issues. 2008:3(2), 179–196.
6. Martin C. Reducing Racial and Ethnic Disparities: Quality Improvement in Medicaid Managed Care Toolkit. Hamilton, NJ: Center for Health Care Strategies, Inc.; 2007.
7. Kim S, Koniak-Griffin D, Flaskerud JH, Guarnero PA. The impact of lay health advisors on cardiovascular health promotion: using a community-based participatory approach. J Cardiovasc Nurs. 2004:19(3);192-199.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PROGRAM
BASICS

PROGRAM BASICS

Objectives

- Introduce educators to the facilitator(s) and to each other.
- Create respect and trust between the educators and the team.
- Familiarize *Nuestra Familia Sana* educators with the purpose of the program by presenting the goals, beliefs, and principles of the program and your organization.

Note to the facilitator

- Information that you are likely to want to modify for your organization will be presented in color orange. You may, however, modify any content to fit your needs.
- Information that is also present in the Educator Training Manual will be presented inside boxes, like the one in the next page. The page numbers in the upper right corner of the boxes refers to the page of the Educator Training Manual in which the text is presented.
- The information outside of the text boxes is unique to this manual and is intended to guide you through the training.

Getting to Know Each Other

1. Arrange the room in a way that promotes interaction among you and the educators. A useful arrangement is placing tables or desks in a U shape. It is important to create an atmosphere of trust so the educators feel free to participate.
2. Prepare all training materials. Materials recommended are supplies for activities, training manuals, refreshments, and nametags.
3. If educators are not already familiar with each other or you, introduce yourself and the team.
4. Start the training with an "ice breaker." Icebreaker ideas can be found online. Sample websites are:
   - https://www.thoughtco.com/classroom-ice-breaker-31410
   - https://www.signupgenius.com/groups/group-icebreaker-activities-adults.cfm

Introduction to the Program

1. Print and distribute an Educator Training Manual to each person so they can follow along. The manuals are formatted to be printed double sided and some pages are purposefully left blank.
2. As a reminder, information that is also contained in the Educator Training Manual is included in the box below.
3. Introduce the program to the group by sharing the following.

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PROGRAM BASICS

Introduction to the Program

Welcome to the *Nuestra Familia Sana* Genomics Program. During training, you will be given the information necessary to perform effectively as an educator. The training will include information on what a lay educator is (again, this is in orange so you can edit or remove this. For example, your organization may need to change it to facilitator or just educator), how to accomplish the duties of an educator, a brief overview of the five environmental factors to be addressed, how they affect family members' health, a detailed overview of genetic and genomic topics, and how to handle administrative procedures. At the end of the training, you will be given the opportunity to practice each step in being an effective *Nuestra Familia Sana* educator and leader in your community. Practice will include role-plays, games, and completion of administrative paperwork.

You are encouraged to participate and be active during the training to ensure that the training program is effective in preparing you for the lessons. The staff will observe, listen, and give feedback during the practice sessions. You are encouraged to ask questions you may have during the training session. The staff wants to prepare you fully for completing the educator duties.

Purpose of the Program

4. Share with the group the purpose of the *Nuestra Familia Sana* Genomics Program. Explain to the educators that the focus is to engage the learners in the genomic content; the environmental components are necessary to engage learners in a topic, genomics that might otherwise be intimidating to them. Parents want to know ways to keep their families healthy. The focus on strategies to keep their families health is therefore a meaningful "hook."

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Purpose of the Program

The primary goal of the *Nuestra Familia Sana* program is to provide informal learning opportunities to Latinx adults with limited English, and often-limited formal education, about genomics. The program also aims to advance their interest in and knowledge about complex genetic and genomic concepts in a culturally and linguistically appropriate manner. Furthermore, it is designed to increase their interest in science more generally and to advance their confidence in their ability to learn about science. The program has the added benefit of teaching learners about how to reduce their families' contact with five different negative environmental exposures, thereby allowing the learners and their families to be healthier now and in the future. This program may also develop leadership skills of Lay Community Educators and builds the capacity of community members to improve their communities.

Principles

5. Present your organization's principles. Add or edit this section as necessary.

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Principles

- Community members have the power to make positive changes within their own communities.
- Community members have legitimate knowledge that must be respected.
- It is important to expand the public's understanding about science.
- Everyone should be provided with culturally and linguistically appropriate opportunities to learn about science topics, and in a manner that is appropriate for their educational background.
- People learn when they feel respected and trust the person guiding the learning process.
- Learning about genomics should be fun.

Confidentiality

6. This following section about confidentiality may differ depending on your target audience, your organization, and your plans for delivering this program. Because this program is designed to be delivered over a period of time, you may need to collect data or personal information on learners. If your organization is collecting any data, explain that keeping all information confidential is essential. Edit the last paragraph under "Confidentiality is Essential" to add relevant information about federal and your state guidelines regarding data collection, storage, and data sharing and how these should be followed.
7. In the US, Latinx individuals are part of a minority, and often a marginalized population; therefore, the success of this program depends on gaining and keeping the trust of the community. This is particularly important for Latinx adults who have limited English fluency and formal education. Share the following paragraph with the group.

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Confidentiality

Trust is essential to the *Nuestra Familia Sana* program. An important element of trust is confidentiality. Nothing you discuss with any learner in the *Nuestra Familia Sana* program should be discussed with anyone other than the learner or members of the staff. You should never discuss any information about a learner with any other person, even if you do not reveal the name. Keep all information in a safe place where no one else can find and read it. Make sure the learners know that their information will be kept confidential.

If relevant, add information about federal and your state guidelines regarding data collection, storage, and data sharing, and how these should be followed.

8. Rosa's story serves as an example of how families can be affected from an educator's lack of confidentiality. Please instruct the group to read Rosa's story individually or as a group.

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It is easy to break confidentiality. Sometimes you do not even realize that you are doing it. Please read the following story below.

Rosa's Story

Rosa is a very friendly and sincere person and has all the characteristics of a good educator. In her passion to help, she found herself in a situation in which she was not sure what to do. As Rosa was doing her community educator work, she arrived at the home of a woman who was participating in the program. Entering the home of Elena, Rosa was impressed by how pretty her house was decorated. They began talking about the importance of protecting unborn children and infants from pesticide exposure, which was the topic for that month. During the discussion, it became clear to Rosa that Elena's family was not in need of anything; they had more than what they needed to nourish themselves.

Continuing with her monthly visits, Rosa arrived at the very humble and simple home of Marta. During the course of the nutrition lesson, Marta, looking very worried, told the educator that she did not have enough food for her young child that day. Rosa, wanting to know more about Marta's situation, asked Marta a series of questions. A very interesting story emerged. Marta told Rosa that she had loaned money to Elena, a friend of hers, because poor Elena did not have any money and Marta did at the time. Elena had promised to pay her back, but she had not paid her anything back yet. Marta thought that Elena was doing better and was able to pay her back, but she was not sure…

9. Lead a conversation about the importance of confidentiality with the following questions.

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Discussion Questions:

1. How do you think Rosa felt in this situation?
2. What do you think Rosa should do in this situation?
3. What would be the best way for Rosa to help Marta with her problem of needing food?
    a. What would you do?
4. What would happen if Rosa told Marta what she had seen in Elena's house that morning?
    a. If Rosa did tell Marta what she had seen in Elena's house, how would this affect the relationship between Elena and Marta?
    b. How would it affect the *Nuestra Familia Sana* program?

2

ALL ABOUT EDUCATORS

ALL ABOUT EDUCATORS

Objectives

- Discuss the characteristics of an educator.
- Convey the role and expectation of educators for the *Nuestra Familia Sana* program.
- Equip educators with tools to meet learner recruitment and retention goals.

Note to Facilitator: Lay community educators (LCEs) are used to deliver information to vulnerable or marginalized populations that have specific needs. In the case of the *Nuestra Familia Sana*, educators were part of the Latinx community and were leaders and trusted members of their communities. Community educators have also been used to teach a wide variety of health-related topics. Evidence suggests that community educators are effective in disseminating knowledge and promoting positive change in behaviors.

If your organization is hiring lay community educators or using an already existing teammate, the training procedures will very similar. You may skip information that is not relevant to your organization's needs. Because of the nature of the program, we recommend that your educators or staff be fluent in Spanish and acculturated to Latinx culture.

For a more thorough review of the ways health educators have been used, see:

- Community Health Worker National Workforce Study. US Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions. 2007; http://bhpr.hrsa.gov/healthworkforce/reports/chwstudy2007.pdf.

What is a Community Educator?

1. Share the following information with the group to give a general idea of what a *Nuestra Familia Sana* educator is.

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What is a Community Educator?

Community educators are persons who provide important information to other members of their community. They are trained in various education approaches. Community educators use their training as a resource for the larger community and they help to identify and address potential problems that may hinder the learners' abilities to learn. They also use their knowledge about their community to diagnose and respond to local conditions so the learners are able to freely interact with the materials/information presented and reach the program's goals.

2. After reading the previous paragraph, you can do the *El Árbol: Una Educator* activity for the group to share their own ideas of characteristics of a good educator.

El Árbol: Un Educador

Purpose

Name and describe qualities, aptitudes, and characteristics of an educator.

Materials
Green poster board
Brown poster board
Red construction paper
Adhesive Tape
Markers or crayons

Instructions

Before beginning the training: The moderator should have the tree ready before the training session. Construct a tree trunk out of the brown poster board. Construct the leaves of the tree out of the green poster board. This tree can be taped to the wall or another surface where it is visible to everyone. Cut out small shapes of fruits or leaves from the red construction paper and leave them to the side. These should be sufficiently large so that a word can be written on it.

During the training: Give out the fruit/leaf shaped pieces of paper to the educators and ask them to write a word that describes a quality, aptitude, or characteristic that they think an educator should have. Then ask them to get up and tape their word to the tree and explain its importance and why they chose it.

Expectations of a Nuestra Familia Sana Educator

3. Share the following information with the educators to explain what your organization will expect from them. You can read the information, or it can be read as a group. Please edit this section in the Educator's Manual as necessary. If the learners are not already identified or part of your network, you may need to add a paragraph about how the learners will be recruited/invited to the program. More detailed information as to where and when the lessons will be delivered may also need to be modified/added.

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Expectations of a Nuestra Familia Sana Educator

As a community educator for the *Nuestra Familia Sana* program, you will help families in your community learn about genetics and genomics while also learning about how to keep their family safe from environmental exposures.

By attending the education classes with us, you will be able to use what you have learned to help center visitors, your neighbors, family, and friends in many important ways.

You will not be a nurse or health professional, but you will have important information that can help other families take better care of their health. Over the next weeks, you will:

- Attend education classes: You are expected to attend training sessions where you will learn information and techniques to be an effective community educator.
- Visit people and share information: You are expected to visit with each of your learners about once a week (or more depending on preferences of your organization) to teach them what you have learned in your education sessions. The information you will present will help learners gain knowledge about genomics and environmental exposures.
- Keep in touch with your supervisor: Let the supervisor know about any questions, problems, or concerns that you might encounter while working in your community.
- Keep good records: The work you are doing as a community educator is important, so we want to know about all the learners that you talk with and what you talk about. We will discuss all forms that you should complete and give to the supervisor.
- Keep information confidential: Since you will be working with the community, people will share some of their problems and stories with you as they get to know you better. It is very important that you do not share this information with anyone else.

Professionalism

4. Share the following and lead a discussion about the importance of acting professionally. Stress that their professionalism not only reflects their values, but it also reflects the values of your organization. You can read the information to lay educators being trained or it can be read as a group.

   There is a sample format for keeping learners' information/records. Please edit this form or create your own document prior to the training if you are planning on keeping track or recording information about the learners. See Appendix 16.

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Professionalism

- Leadership: Know that you are an example and will be watched closely in your community. Try to practice all methods that you teach to lead your community by example.
- Home visits: Please always show up to your appointments. If you cannot complete your visit, let them know in advance so they will not be expecting you.
- Present materials: Present all materials that you are given for the learners. If you find you are running out of time and you are not able to extend your stay, reschedule another time to complete the lesson. Please be aware that some learners may not be able to read or write in English or Spanish. Therefore, leaving materials for learners to read may not be appropriate.
- Communicate effectively: When speaking to the learner, hold eye contact, speak clearly but pleasantly and always check for learner understanding.
- Dress professionally: Dress in a way that portrays you as a knowledgeable community leader. Avoid wearing clothing with large labels, clothing that is tight, or any type of athletic wear.
- Problem solving: If you find yourself with a problem that you cannot solve, please contact your supervisor so she/he can help you reach the best solution possible.
- Cultural competency: Although the majority of the learners will be Latinx, there will be variations in backgrounds and religions. Please be careful not to offend anyone with any demeaning comments. Generally, if you speak in a positive and encouraging way, you will likely not be offensive. If you do happen to offend a learner, apologize.
- Recording information accurately: Remember when you are recording information always try to be accurate in recording the learner's responses. Write as clearly and neatly as possible. Always include detailed observations in your notes. You can never write too much.

Recruiting Learners

5. If your organization will have educators find and recruit learners for the program, then follow the text below. If your learners are already identified or part of your network, then remove the text in the box below from the Educators Manual. Review the following paragraph with the group and emphasize the characteristics that they need to look for when recruiting families.

   It is important to add the learner characteristics for inclusion desired by your organization to this section of your manual and to the Educator Training Manual. Examples of characteristics are age, sex, race, or family structure. A recruitment form can be created and used by the educators to recognize potential learners.

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Recruiting Learners

You will find your own individual style of recruiting learners to be a part of the *Nuestra Familia Sana* program. You will approach people differently depending on their personalities and your relationship with them. Some people are going to be very interested in learning more about protecting their family from environmental exposure. Others are going to need convincing that participating in the program is worth their time.

As you interact with people, you need to remember for someone to qualify as a "learner" he/she needs to be:

Specific to each organization

As you are recruiting learners, always remember: **You are the expert in your community.**

Add information here about your organization's recruitment goals if necessary/appropriate.

6. If appropriate, discuss with the group the ways in which the staff will support the educators in their recruitment process.
7. Also, think about your organization's recruitment and retention goals and add a paragraph if necessary/appropriate.
8. If appropriate, ask the following questions to initiate a discussion among the educators about ways in which to recruit most effectively. Edit or remove if educators will not be finding learners in the community.

   Note: The answers to the discussion questions are limitless and depend on your organization's settings and goals. Samples of possible correct answers have been provided in italics. Please note that these answers are not found in the Educator Training Manual. If educators are shy or do not answer, you could lead the discussion by offering some examples. You can also use a map to help visualize possible locations.

Discussion Questions:

1. Where are the kinds of places you can go in your communities to find people to participate?

   Places where educators can find learners are:

   - *Churches*
   - *Schools*
   - *Laundromats*
   - *Tiendas/grocery stores*
   - *Parks or soccer fields*

2. If you find someone who is not sure that they want to participate, how can you convince them that the *Nuestra Familia Sana* program will be worthwhile?

   Educators can convince people to participate in the program by:

   a. *Being polite when you introduce the program*
   b. *Telling them that the program is free*
   c. *Telling them that all information is confidential and will not be shared with anyone outside the organization*
   d. *Telling them that it will help them learn simple, but effective, ways to protect themselves, and the entire family, from negative environmental exposures.*

   Note: It is important not say that this program is intended to teach about genetics and genomics at first, as to not to intimidate potential learners.

Note to facilitator: It is recommended that you provide the educators with a resource list that may include resources from your area. Informal STEM learning opportunities in the area should be provided (e.g., local science museum). Other common content for a resource list includes agency names, addresses, and telephone numbers for healthcare, mental health services, food pantries, and child services.

Personal Safety

9. Safety is very important. Share briefly the following paragraph to help them identify and deal with dangerous situations. Edit the content of the box below if the educators are not doing in-home visits or lessons will be taught in your organization's space.

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Personal Safety

If the lessons will be delivered outside of the organization, educators should follow some basic safety guidelines. If the educator or organization does not know the learner or was not referred to them by a trusted contact who knows them, the lessons could be taught in safe local community spaces that are conductive to learning, such as libraries or parks.

Traveling to unfamiliar places to meet people (some of whom you do not know) can be uncomfortable. It is important that you feel safe and secure at all times while teaching lessons outside of the organization. To help you become more comfortable with the ever-changing work environment, be aware of your surroundings when in the community and note any unusual occurrences. If you feel that your personal safety is compromised at any point, remove yourself from the situation and contact the supervisor immediately. Examples of unsafe situations are listed below but use your best judgment. Leave the vicinity immediately in these situations:

- If the learner threatens you verbally or physically.
- If someone other than the learner is threatening you or creating an unsafe situation.
- If any weapon is displayed in an unsafe manner or a manner that makes you uncomfortable.
- If you suspect any sort of abuse.
- If you pull onto the learner's street or driveway during an unsafe situation, for example, fighting or unusual crowds of people.
- If you are sexually threatened or harassed by the participant or others in the community.
- If there are aggressive dogs or other hostile animals in your immediate area or that have access to you.
- If there is threatening weather that may pose a risk or danger to driving, for example severe thunderstorms or hurricane-like conditions.

10. To start a discussion, ask one or two educators to remember and describe a time when they had to deal with a dangerous or difficult situation and ask the group of what they would do in that situation.

Personal Health

11. This program was partly delivered during the beginning of the COVID-19 global pandemic; therefore, some strategies were created to keep educators and learners safe from disease transmission for that phase of the pandemic. If COVID-19 precautions are needed at the time that you implement this program, please refer to your organization's policies and CDC guidelines at https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/index.html.

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Personal Health

Please keep in mind that the learners' and the educators' health is very important to this organization. To stay safe and prevent any spread of COVID-19 or other diseases, such as influenza, please follow these guidelines:

- When necessary or appropriate, teach lessons in large indoor spaces with good ventilation.
- If you are at a learner's home and the weather is appropriate, you may ask to deliver the lessons outside on the porch or driveway. A portable table and chair will be necessary for this.
- Lessons during the COVID-19 era should only take place with one learner, with multiple eligible adults living within the same household, or learners who are already comfortable being with each other.
- Educators, participants and others present should wear a facemask during the lessons. If participant does not have a mask, please provide one.

Prior to any in-person learning session, the educator will be required to ask learners the following questions:

- Have you had a fever, cough, shortness of breath, vomiting or diarrhea in the last 7 days?
- Have you had contact with someone who was diagnosed to have COVID-19 in the last 10 days?
- The educator is required to ask herself the same questions. If the learner and the educator respond negatively to all questions, she may proceed with scheduled in-person visit. Otherwise, lessons should be rescheduled for at least 10 days.

3

GENOMIC BASICS

GENOMICS BASICS

Objectives

- Discuss basic information about cells, DNA, and genes with educators
- Teach about mutations and their relationship to disease
- Explain the concepts of cell communication and disruption
- Have a dialog about heredity and fertilization
- Discuss basic concepts about epigenetic changes with educators
- Discuss the relationship between genetic risk, life factors, and disease

Procedures

This is one of the most important sections of this manual. It is imperative that the educators have a good understanding of the basic genomic information so they are able to teach and answer simple questions the learners may have. It may be a good idea to have educators go through this training in at least two separate sessions (especially if they are not familiar with the concepts).

This section covers all the science concepts in the lessons. It also gives educators slightly more information and details than what they will be teaching, but it will assure that they will be able to answer simple questions learners may ask. When educators go through the lessons with you, it will serve as a review of the science concepts.

Note to facilitator: You will need materials for the hands-on activities for this section. We have included a list of items needed for all the hands on activities in Appendices 1-12, including a link to a relatively inexpensive microscope and wireless camera. A wireless camera will allow you to show the view from the microscope onto a tablet. This is particularly useful during activities as educators and participants are able to see the same image in focus. The DNA model suggested is sturdy and does not contain any small parts that could become a choking hazard (in case learners have small children), but will require modifications allow for mutation demonstrations. You are able to use any other DNA model of your choice as long as it allows base pair changes to show mutations.

Cell, DNA and Genes

1. Present the following about cells. Encourage educators to ask any questions at any point during this section.

Page 22

GENOMIC BASICS

Cell, DNA and Genes

This section will cover all the science concepts in the lessons. This section gives more information and details than what will be presented to the learners, but it will assure that you will be able to answer simple questions learners may ask.

What is a Cell?

All living things are made of cells. Cells are the most basic unit of life. Some living organisms, like simple bacteria, are made of just one cell. Most other living things are made of billions or trillions of specialized cells.

Cells are very small structures that are usually only seen through a microscope. Cells are small structures that make up our bodies. The cells that make up different parts of the body look different from each other. For example, there are different types of cells that make up the heart, lung, and brain. All cells have specialized jobs that are specific for the organs in our bodies.

Most human cells contain a nucleus. A nucleus is the compartment in the cells that contains our genetic information in the form of DNA.

Note: red blood cells and blood platelets are human cells without a nucleus. This means that these cells do not have our genetic information.

Nucleus

Muscle cells

Hands on activities:

2. Have a microscope ready.
3. Show educators how to set up the microscope. If you are using a tablet with a wireless camera, also show the educators the set up process (note: with most wireless cameras, this is a one time process). Instructions on how to set up the microscope and camera, and mount and focus a cell slide on a microscope are found on Appendices 1 and 2.
    a. Begin the activity by instructing the educator on how to mount the cheek cell slide. Allow them to identify a good view of the cells with the microscope.
    b. Explain that they are looking at a cluster of cells from inside the cheek.
    c. Ask the educators to point out a single cell. If they cannot point out a single cell, point one out again. Ask participants again to point out a single cell (not the one you pointed out).
    d. Then, ask them to point out the nucleus in the cell they identified.
    e. Always encourage questions.
    f. You could repeat all previous steps with a different cell slide (the nerve cells, for example).
4. Please note: if you are not able to use microscopes, there are cell slide images from cheek and neuron cells that could printed and used in lieu of the microscope. These images are found in Appendix 4.

5. Now you will present information about what DNA is, how genetic information is stored inside DNA, and DNA's roll in heredity. Read the following with the educators.

Page 23

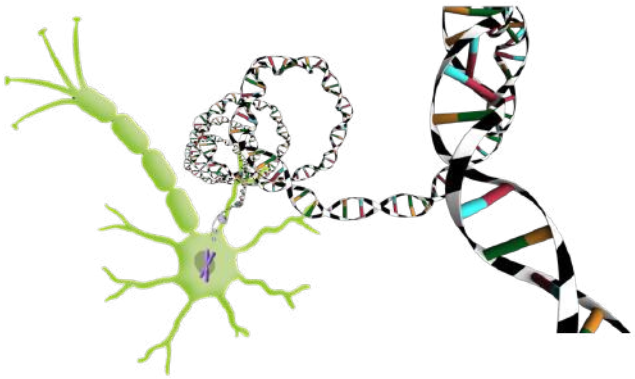
How is all Genetic Material Stored?

DNA stands for deoxyribonucleic acid. DNA is the genetic material in humans and all other organisms. Almost every cell in a person's body has the same DNA inside the cell nucleus. The information stored in the DNA ("genes") is responsible for the development and function of an organism.

In cells, DNA is arranged in structures called chromosomes, and each chromosome consists of one long strand of DNA. The information in DNA is stored as a code made up of four chemical bases: adenine (A), guanine (G), cytosine (C), and thymine (T). The order of the bases determines the information that the cells use to make and maintain an organism. Think of the way in which letters of the alphabet create specific words depending on the order in which they are placed.

DNA bases pair up with each other in a certain pattern to form units called base pairs. Base pairs are arranged in two long strands that form a spiral called a double helix. The structure of the double helix looks similar to a twisted ladder as seen below.

A cell (neuron) A piece of DNA



6. Use the DNA model to show base pairs and the double helix. Explain that this is what a very small piece of DNA looks like. Allow educators to hold the model (if they do not have their own) and to ask questions.

7. Before continuing, ask the educators how many colors they see in the middle section of the DNA. There are four different colors, each one representing a different base.

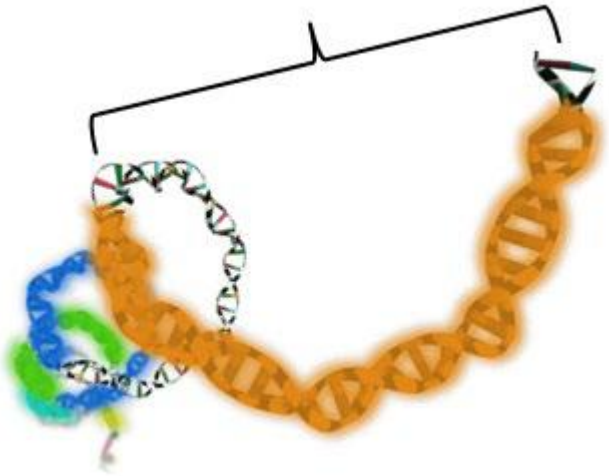
8. Next, review the following information about genes.

Page 24

What is a Gene?

Genes are made up of smaller sections of DNA. Some genes act as instructions for the cell to function. Humans have approximately 25,000 genes in each cell. All cells that have DNA contain the same genetic information.

One gene



If all cells have the same genetic information, how do cells become different? Cells do not use all of their genetic information available. Each set of cells uses a unique combination of genes to become that particular cell type. For example, cells in the heart only use a certain gene combination, allowing them to become heart cells and work in the way a heart needs.

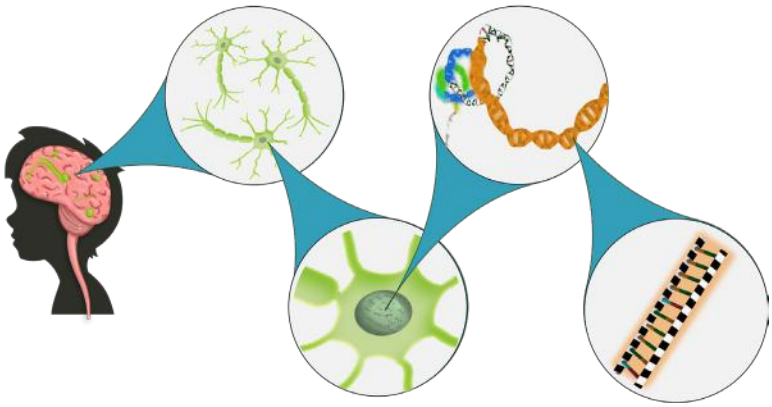
Most genes are the same in all people. A very small percentage of genes (~0.3%) are slightly different from person to person. The combination of small differences in a person's genes is one thing that makes each person unique.

9. Review the text below to make sure it is clear what the relationship is between DNA and genes.

Page 24

Relationship between DNA and Genes

- All of our body parts, like the skin, eyes, lungs, and brain, are made of different type of cells. Each cell type is specialized in doing a different job in our body.
- Here we see the brain, which contains mostly brain cells, also called neurons or nerve cells.
- Inside the cell, we can see a nucleus.
- Inside the nucleus are small chains of DNA that contain all of the person's genetic information. Every cell in this person's body has the same DNA.
- Some parts of the DNA form genes. Genes are instructions that tell the cells what to do so the body can function.



10. After reviewing the information, have the educators recall some information by asking questions about the information. Recalling the information promotes learning. Examples of questions are:

    a. Where can you find DNA? *In the cell's nucleus*

    b. Where can you find a gene? *Inside the DNA. Recall that a gene is a segment of DNA that provides instructions.*

    c. What is the function of a gene? *Gives the cell instructions needed for normal cell function*

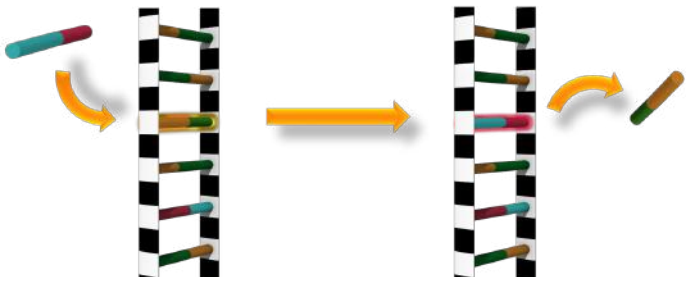
Mutations

11. After learning about genes, review the following information about mutations. Encourage educators to ask questions about the materials.

Page 25

Mutations

- Genes are codes that provide the instructions for everything the cell does. Genes usually do not change. When a change occurs in the DNA sequence, the gene undergoes a mutation. A mutation is a change in one or more parts of a gene.
- Mutations can occur naturally (mostly due to mistakes when the DNA is copied), but mutations are more common when the cells are exposed to certain chemicals like those found in cigarette smoke or environmental exposures like the sun's ultra violet (UV) light.
- Often, mutations do not cause a problem, but sometimes they can lead to diseases, as the cell is no longer able to continue its normal function. Think about how changing a letter in a word (rod > pod) would make it have a different meaning.
- Below is an example of a base pair (red and blue) taking the place of a different base pair (green and yellow). This mutation disrupts the original sequence of the gene. This change may cause the cell to reproduce uncontrollably, leading to cancer. Not all mutations lead to disease.
- Most mutations are permanent.



Activity

Note: Prior to this training, you will need to modify the DNA model to allow it to create mutations if you are using the DNA model that is listed in Appendix 5. If you are using another DNA model, please make sure you are able to show mutations (i.e., bases are removable).

12. Ask educators to remove the DNA segment that is attached with Velcro.
    a. Give them the additional piece. Point out that it has different base colors.
    b. Ask educators to attach the new piece into the model. Explain that this small change in the DNA chain is a mutation. Mutations can change the cell's instructions and may lead to cancer.

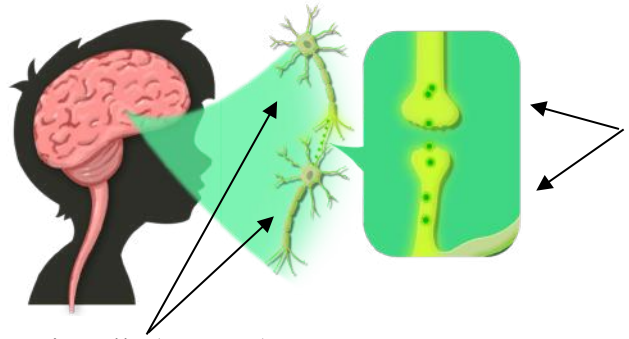
Cell Communication

13. Next, you will talk about how environmental factors can also cause health problems in ways that are unrelated to genes or DNA.
14. Review the following information about cell communication with the educators.

Page 26

Cell Communication

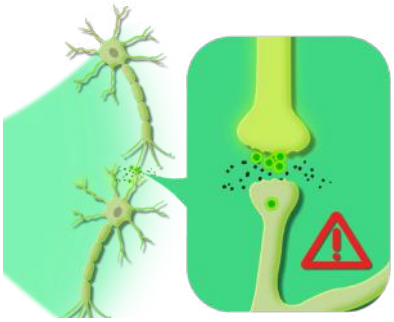
- We learned that environmental exposures such as secondhand smoke or UV light could affect our genes and cause mutations. Some substances, like lead, can also cause harm, even without affecting our DNA or genes.
- Our brain cells, called neurons (also called nerve cells), need to talk to each other for all of our bodily functions, such as sensing temperature, moving your muscles, or thinking. They communicate by sending and receiving chemical signals.



Two brain cell endings talking to each other by sending and receiving chemical signals

Brain cells (neurons)

- Some chemicals, like lead, harm brain development in children by disrupting normal communication between brain cells. Cells in the brain need to communicate with each other to function correctly. Lead keeps cells from talking to each other correctly. When a child has been exposed to lead, the connections between brain cells do not work correctly. Abnormal cell communication can also cause problems when adults are exposed.



Hands on activity:

15. Explain to the educators that nerve cells communicate by sending signals from one cell to another. In this activity, you will be using paper bowls to represent the end of two different brain cells (nerve cells). The marshmallows represent the signals that cells use to communicate. The black paper pieces represent lead. Instructions for these cell models are in Appendix 6.
    - Normal cell communication: Place one bowl upside down (with the holes on top) in the plastic box. Fill the other bowl with some marshmallows and hold on top of the second bowl (you may need to cover the holes with your hand so the marshmallows don't fall out before you start). Shake the top bowl to allow marshmallows to go into the holes in the bowl below. Normal brain cell communication happens when the signals from one cell move to the next cell.
    - Disrupted cell communication: Insert some paper pieces on top of most holes of the upside down bowl. Fill the other bowl with some marshmallows and hold on top of the second bowl with paper pieces. Shake the top bowl. Most marshmallows will fall out and a few will go into the bottom bowl. This represents lead's interference with communication between brain cells. The signals sent from one cell do not make it to the next cell. Because of this, cells cannot communicate appropriately.

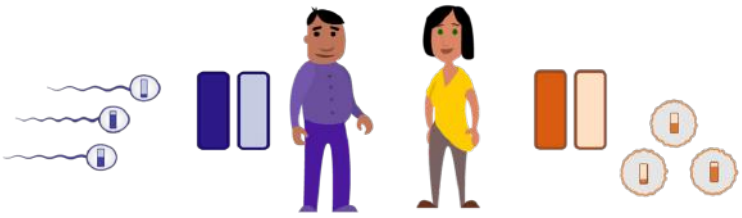
Fertilization

16. Now the educators will learn about fertilization. Educators will need this basic knowledge to understand the information about heredity. Read the information below.

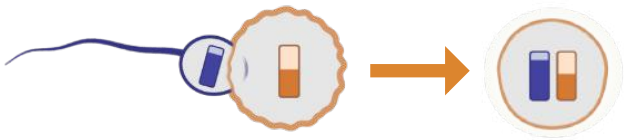
Page 27

Fertilization

- We learned that almost all cells contain a person's genetic material in the form of DNA. Males make sperm for reproduction, but unlike the other cells, sperm only contain exactly half of the male's DNA. All sperm are different. Every sperm contains a different and random mix of the male's DNA.
- Females have eggs, each of which also contain exactly half of their DNA. Like the sperm, each egg contains a different and random mix of her DNA.
- Below we see a man's genetic material (half from his father in dark blue and half from his mother in light blue). To the left is his sperm, which is a random (and mostly unequal) mix of his genes.
- We also see a woman whose eggs are also a random mix of her genes (half from her father and half from her mother).



- Fertilization happens when an egg and a sperm join together. A fertilized egg contains all the genetic information it needs to become a baby. That baby has half of his or her genes from each parent.

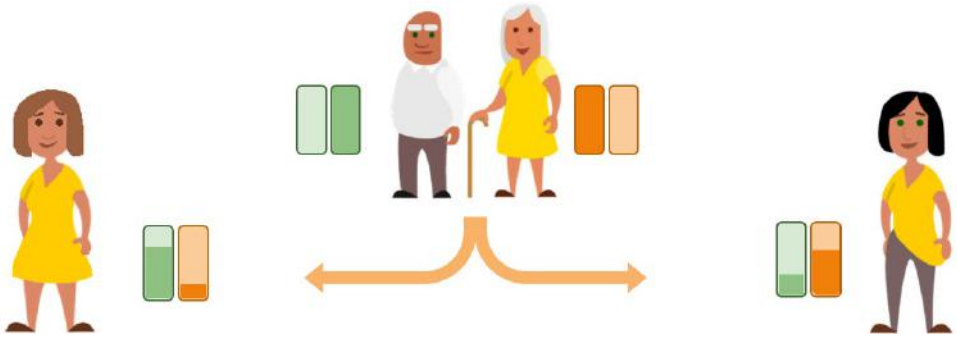


17. The next sections will cover information about why siblings look similar to each other, but are able to have different characteristics. It will also teach about the difference between fraternal and identical twins. Review the following.

Page 27

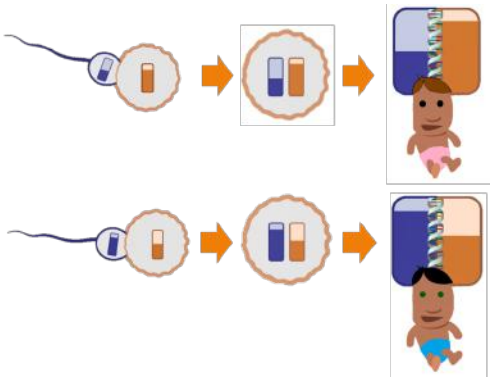
Siblings

- Siblings sometimes look a lot like each other and sometimes they have very different characteristics or physical appearances. Siblings look like each other because they share some of the same genes. On average, they share 50% of their genes.



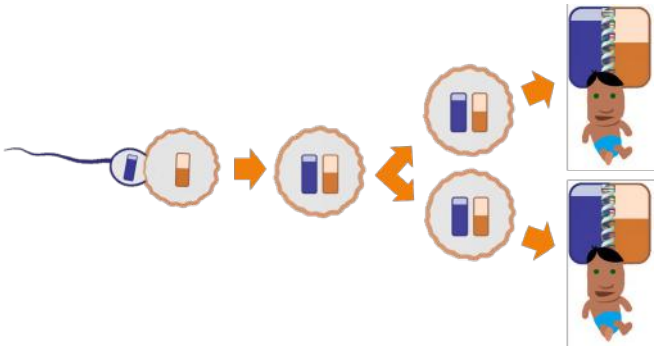
Fraternal Twins

- Fraternal twins are not identical and look like any other siblings.
- Normally, a mother releases only one egg per month, but sometimes she can release two or more eggs. Fraternal twins are formed when two different sperm fertilize two different eggs at the same time.
- Fraternal twins do not share the exact same DNA. They can be the same or different sex (male and male, female and female, male and female).
- Below we can see an example of one pregnancy with fraternal twins.



Identical Twins

- Identical twins are unique as they form from a single egg fertilized by a single sperm.
- Soon after fertilization, the fertilized egg splits into two exact copies.
- Identical twins share the same DNA; therefore, their genes are nearly identical.
- Identical twins look the same or almost the same. Identical twins are always the same sex (male and male, or female and female).



Note to facilitator: Depending on your timeline and time availability, you may continue to the next sections or this could be a good section to finish your training day. You may pick up again for the next sections in your next session.

Epigenetic Changes

18. For this section, you will need the pipe cleaner DNA model. Instructions for this DNA model are in Appendix 7. Each educator should have their own.
19. Review the following statements. Make sure educators understand that the epigenetic changes are different from mutations (mutations in a gene are caused by a base change while epigenetic changes are caused by opening or closing an entire gene).

Page 29

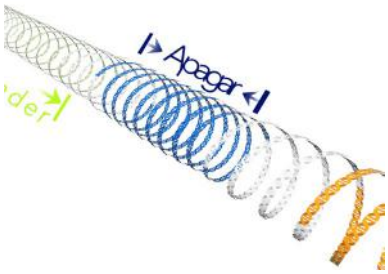
Epigenetic Changes

Each cell in a person's body, with few exceptions, has the same DNA. Genes are contained in the strands of DNA. This means that each cell in a person's body has the same genes. But we know that different types of cells look and function differently from each other. Muscle cells in the heart look and function differently from nerve cells in the brain. This is because different sets of genes are turned on and off in heart and nerve cells.

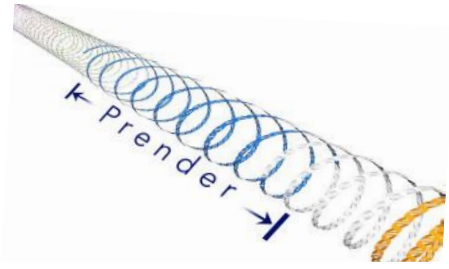
- A gene is inaccessible to the cell when a segment of the DNA containing that gene is tightly wound or closed. The instructions contained in that gene cannot be found or accessed. The gene is turned off.
- When the DNA containing a gene is loosely wound or open, the gene is accessible. The instructions contained in that gen can used. That gene is turned on.

Epigenetics is the study of how cells control gene activity (i.e., turning on and off) without changing the DNA sequence in a gene. Epigenetic changes are modifications to DNA that regulate whether genes are turned on or off.

- Epigenetic changes that cause DNA to become tightly wound close or turn off genes.



- Epigenetic changes that cause DNA to loosen open or turn on genes.



Page 29

Why does it matter if a gene is open or closed?

- ❖ The instructions in genes that are open can be accessed or used. The instructions in genes that are closed cannot be accessed or used. Cells work best when certain genes for that cell are turned on and certain genes are turned off.
- ❖ An epigenetic change either makes a strand of DNA more tightly wound, or makes a strand of DNA less tightly wound.
- ❖ If a gene that is usually open becomes tightly wound up or closed due to an epigenetic change, the cell is unable to use or access that gene. On the other hand, when a gene should be closed and an epigenetic change opens the gene, the cell may not be able to perform its specific role correctly. Therefore, epigenetic changes can lead to abnormal gene activity.
- ❖ Epigenetic changes do <u>not</u> change DNA or genes themselves. Epigenetic changes alter whether genes are accessible or used (i.e., turned on or off).
- ❖ Epigenetic changes can cause better health or contribute to negative health conditions.
- ❖ Some epigenetic changes can be temporary, and some can be permanent.
- ❖ Behavioral influences and environmental exposures, such as a person's diet, can cause epigenetic changes.
    - Examples of environmental exposures: exposure to secondhand smoke or Bisphenol-A (a chemical widely used in plastics). (NOTE: Secondhand smoke can also cause mutations.)
    - Examples of habits or behaviors: diet, exercise, or smoking. (NOTE: Smoking can also cause mutations.)

20. Ask educators to hold the pipe cleaner DNA model. Have them see that this has three different colors. Each color represents a gene. A gene is a segment of DNA that contains instructions. Ask them to hold the DNA model in a way that the genes are tightly coiled. Tell them to choose one gene and pull it some to uncoil it slightly. This change (going from tightly coiled to less tightly coiled), is an epigenetic change. Explain that by opening this gene, it allows the cell to read the gene and create components the cell needs.

Note: it is important that educators understand that the coiled pipe cleaners do not only represent the double helix DNA, but instead, it represents the double helix coiled in itself. This means that the DNA strands are coiled to create a double helix, and this then coils again to create a compact DNA structure. This is how DNA is stored in the nucleus (in the image below, histones can be seen near the purple chromosome but are not shown for simplicity).

21. Explain that an epigenetic change to open or turn on a gene is not always necessarily good. Opening a gene could be harmful. Closing or turning off a gene is not always harmful, but could be beneficial.

Hands on activity:

22. The educators will now review what they learned about epigenetic changes using the pipe cleaner DNA model. You will and each educator need a DNA model and a bag clip.

    Explain that the twisted pipe cleaners represent one piece of a strand of DNA. The three colored sections represent three different genes. The clip represents what the cell uses to find or access the instructions in the gene.

    The pipe cleaners should be twisted in loops to resemble DNA strands.

    - Give each educator one DNA strand. Ask them to hold only the green gene at each end. Ask them to show an epigenetic change that would turn on the green gene.
        - Educator should loosen and extend the gene.
    - Approach an educator and attach the clip to the beginning of their green gene.
        - Explain: The cell can now read the instructions within the open gene.
    - Move clip down to the end of the gene to show the clip reading the gene.

- Now ask educators to hold the orange gene at each end. (If they are holding the orange gene so that it is tightly closed, ask participant to move his/her hands a few more inches apart to where the gene is open.) Ask them to turn off the orange gene.
    - Educators should close it more tightly.
- Try to attach the clip to the closed orange gene, but do not attach.
    - Explain: The gene is so tightly closed that the clip cannot attach to read the gene.

23. Remind educators that identical twins are born with the exact same genes. With time, the way their genes work becomes a little different. One reason why their genes may work slightly differently is because of epigenetic changes. The two sets of twisted pipe cleaners represent the DNA of two identical twins.

    - You hold the second set of twisted DNA pipe cleaners to represent one twin. Educators will hold the second model.
    - Ask educators to hold the blue gene at each end. Now ask them to show another epigenetic change that would turn off (wind tightly) the blue gene in their model. Your strand stays the same. This represents a genetic change in one identical twin but not in the other, which was caused by an environmental exposure or behavior.
    - Explain: Over time, the twins' different environmental exposures or behaviors may cause epigenetic changes that can affect how their DNA works. This is the reason why one twin may develop a specific disease and not the other twin, or why one twin may start to look a bit different from the other twin.

24. Finally, ask them to tell you possible reasons for the epigenetic change to the blue gene.

    Expected answers:

    - Environmental: Exposure to certain chemicals such as secondhand smoke or BPA (but NOT lead). Secondhand smoke can cause mutations. However, exposure to secondhand smoke can also change the way that genes work by causing epigenetic changes.
    - Behavior: Exercise, diet, or smoking. See comment above about secondhand smoke.

Genetic Risk

25. The educators have learned what DNA and genes are, and how they are passed down to children. Now they will learn about the risk for disease that a person can inherit or create. Review the following.

Page 31

Genetic Risk

- We learned that children, regardless of their sex, inherit half of their genes from mom and half from dad. With those genes, they inherit physical traits, as well as chances of getting some diseases.

- In this picture, we see that the mother has two copies of her genes. She passes down one-half of her genes to the child. The father also passes down one-half of his genes. In this example, this baby received a gene or genes associated with a risk of developing a disease from the father. Because this child carries a gene associated with a disease, he is more at risk of developing this disease than someone without that gene.
- For most common diseases, however, inherited genes alone do not determine the cause.
- Many diseases, including type 2 diabetes, are caused by a combination of the environment, genes, and behaviors. Genes are just one part of the puzzle.
- Having a family member with a disease means that there is an increased risk for having that disease, compared to someone without a family history.
- Having an increased risk means that a person is more likely to get the disease than someone else is. But, having an increased risk does not mean that the person will definitely develop it.

26. It is important that educators have learned the relationship between heredity, behaviors, exposures and the risk for disease that a person can inherit or create. Start a conversation with the educators to gauge their understanding. You could start this conversation by asking the following questions.

    - Rosa's mother has diagnosed diabetes type 2. Rosa is young and healthy and enjoys exercising.
        - *How does her behavior affect her chances of developing diabetes later in life?*
        - *Why?*
        - *What else could affect her risk*?

Hands on activity:

27. For this activity, you will need to have a puzzle found in Appendix 8.
28. Give the educators the puzzle pieces and explain that these are images of things that could affect our health. Ask them to put the puzzle together. Instruct them to tell you why each piece they place plays an important role in risk for a disease.

    - Heredity: Children inherit genes from both parents. Children could inherit different forms of genes that increase their risk of developing a disease.
    - Things we are exposed to: Some chemicals and substances in our environment could increase the risk of disease.
    - Behaviors: Some things we do can increase or decrease the risk of a disease.

Putting it All Together

29. The educators have now learned all of the scientific content. The last section will review terms and put all the concepts together. To begin this section, ask the educators some questions to make sure they understand what DNA and genes are, and their role in heredity. Examples of questions are:
        - *What is DNA?*
        - *Where can you find a person's genetic information?*
        - *What is a gene?*
30. If necessary, have the educators review those terms.
31. Go through the following section to review the relationship between all the concepts and terms.

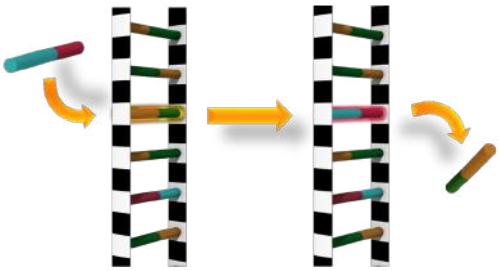
Putting it All Together

Important terms:

- DNA: DNA is genetic material stored inside every cell. The information stored in the DNA is responsible for the development and function of an organism.
- Genes: Genes are made up of smaller sections of DNA. Some genes act as instructions for the cell to function. All cells that have DNA contain the same genetic information specific for that person or organism.

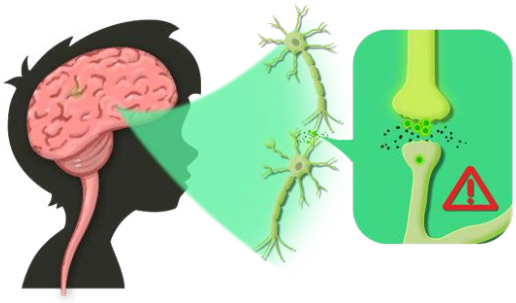
We have learned that behavior, chemicals, and substances in the environment affect the body differently.

- First, some chemicals and some substances in our environment can change genes.
  - Mutations are changes to parts of the DNA. Mutations are mostly permanent. Mutations can occur naturally, but chemicals in our environment can make them occur more often.



- A second way chemicals and behaviors can affect health is by changing how genes work, without causing mutations.
  - Epigenetic changes can turn some genes on and other genes off. Some epigenetic changes can be harmful and some beneficial. Some epigenetic changes are temporary and some are permanent.

- There is also a third way chemicals and substances can affect health without affecting DNA or genes.
    - Sometimes chemicals and substances can disrupt the normal processes of cells without affecting the genes. Lead, for example, prevents normal brain development. Lead interferes with the communication between cells in the brain, affecting the way cells work.



- Lastly, inheritance also plays a role in determining health.
- A few diseases are purely determined by genes, but many diseases, including type 2 diabetes, are caused by a combination of the environment, genes, and behaviors.

Other Resources:

If you have access to a computer or tablet, you can show the following interactive graph to get a sense of the size of a human skin cell (in pink) relative to a grain of rice or coffee bean.

Note: this interactive activity is only in English.

- https://learn.genetics.utah.edu/content/cells/scale/

Other Spanish and English resources:

- https://www.genome.gov/es/About-Genomics/Introduccion-a-la-genomica
- https://www.genome.gov/genetics-glossary/c#glossary

Other English-only resources:

- Studying cells from NIH

  https://www.nigms.nih.gov/education/fact-sheets/Pages/studying-cells.aspx

- Help Me Understand Genetics

  https://medlineplus.gov/genetics/understanding/
  https://medlineplus.gov/genetics/understanding/basics/dna/

Hands on activity:

32. Give educators the activity sheet "*How Does it Cause Harm?*" This page, its images and instructions are in Appendix 9.
33. Explain to educators that you will review the three ways the environment and behavior can cause changes and harm. The images represent things in our environment and behaviors. Ask them to place them in the correct category. Encourage them to talk about why they are making that decision.

    Correct placements are as follows:

    - Mutations:
        - Image of cigarettes
        - Image of sun
    - Epigenetic Changes:
        - Image of a person exercising
        - Image of cigarettes
        - Image of plastics labeled with BPA
    - Normal Cell Disruption:
        - Image of lead
        - Image of pesticides

4

ENVIRONMENTAL EXPOSURES: THE "HOOK"

ENVIRONMENTAL EXPOSURES: THE "HOOK"

Objectives

- Learn about five environmental exposures: secondhand smoke, lead, BPA, nutrition basics, and pesticides
- Discuss possible health effects of each environmental exposure
- Discuss simple ways to protect yourself and your family from environmental exposures

This section of the manual covers the environmental components that were included to engage learners in a topic that would introduce the science component (genetics) that might otherwise be intimidating to them. The environmental components act as a meaningful hook for adults, particularly parents, as they are open to learning ways to keep their families healthy.

You will review the environmental concepts from all the lessons using the five Educator Lesson Manuals in this section. These are found on the website: https://school.wakehealth.edu/Departments/Family-and-Community-Medicine/Nuestra-Familia-Sana

Note to facilitator: This section acts as an example of how educators will teach learners. Encourage educators to teach the lessons as you will teach them.

These lessons have various hands on activities to engage learners in the environmental materials. Depending on how your organization delivers these lessons, you may or may not choose to use some or all of the hands on activities materials. All are inexpensive and simple to make. We have included the list of items for each hands on activity in Appendices 10-12. These activities do not contain any small parts that could become a choking hazard (in case learners have small children).

Please note that all of the environmental information you will cover is also found in the flipcharts. Flipcharts can be used as a teaching aid.

Lessons Structure

1. Introduce the topics of each lesson and explain that each lesson is divided into five sections.

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ENVIRONEMTAL EXPOSURES: THE HOOK

Lessons Structure

The *Nuestra Familia Sana* Program is composed of five lessons. Every lesson teaches a different subject. This section will review the environmental information for each lesson. The subjects for each lesson are:

- **Lesson 1**: Secondhand Smoke
- **Lesson 2:** Lead
- **Lesson 3:** BPA
- **Lesson 4:** Nutrition
- **Lesson 5:** Pesticides

Each lesson is broken into five sections:

1. *Video* - introduces all the content of the lessons
2. *Background* – introduces the environmental topic
3. *Health effects* - gives an overview of the possible health effects from the exposure
4. *Learning science* - gives an overview of the genetics and genomic concepts. The science component is not always in the same order.
5. *Behavior change* – gives learners concrete ways to reduce exposure to environmental component.

Environmental Exposure Lessons

2. Review each of the lessons in the following manner. We suggest you print and add the environmental sections only to this section for review. Please instruct the educators to follow these same steps when teaching their lessons. For each of the lessons, you will conduct the following:
    a. Review the assessment question. An assessment question has been included at the beginning of every lesson to try to understand the educator's knowledge level about the environmental topic. This question also acts as the introduction to the topic.
    b. After your brief discussion, show the video for that lesson. Once the video ends, encourage educators to ask questions about the video.
    c. Start the *Background* section by asking the transitional question, which will make the educators recall information they just saw in the video. Then, review that section that introduces the environmental topic. After reviewing the information, encourage educators to ask questions.
    d. Continue to *Health Effects*, beginning with the transitional question. After reviewing the information, encourage educators to ask questions.
    e. Finally, review the *Behavior Change* section, beginning with the transitional question. After reviewing the information, encourage educators to ask questions.

3. When applicable, conduct the environmental hands on activities for that topic. These will cement the topic.

5

TEACHING BASICS

TEACHING BASICS

Objectives

- Familiarize educators with the concept of informal learning
- Help educators identify teaching strategies
- Identify simple ways to keep learners involved throughout the program

Informal learning

1. Discuss with educators what informal learning is with the text below. Note, this information is <u>not</u> found in the Educator Training Manual but is intended to be reviewed during training.

    - Informal learning: Most adults engage in some form of informal learning throughout their life. Informal learning is a self-driven activity leading to an increase in understanding, knowledge or skill that occurs outside of formal educative institutions (schools or learning organizations).[1] Informal learning remains crucial for adults to become or remain knowledgeable about STEM topics.

2. Continue to this section by asking educators how they prefer to learn, and then discuss the following.

    - Learning styles: As previously mentioned, Latinx adults have high interest in topics that will improve their families' well-being. This program focuses on five concrete ways to reduce negative environmental exposures to encourage participation of learners in a topic that might otherwise be intimidating, that of genomics. To do this, the program integrates different learning styles [visual (seeing), auditory (listening), and kinesthetic (doing)][2]. People learn better with different delivery modes or a combination of methods.

        a. Flipcharts: Used as a visual outline and provides structure for listening.[2]
        b. Narratives or storylines: Using narratives or stories can help people learn science when there is an orderly progression of events that is connected to the scientific explanation. Stories can be particularly effective when viewers are drawn into the plot,[3] relate to the characters, and have a strong emotional response to the story.[4, 5]
        c. Manipulatives: Participation in hands-on-activities reinforces concepts as learners manipulate objects and recall information in the process of engaging in the activities.[6]
        d. Conversation: The lessons are designed to encourage the learner to take an active role in the learning process by encouraging back and forth communication between the educator and learner.[2] When you present the information, encourage natural conversations and questions.
        e. Recalling information: Giving participants opportunities to recall information they have learned will help them retain information about the topics.[6]

Teaching Tips to Facilitate Learning

3. Below are some teaching tips for educators to keep in mind while teaching adult learners. Begin by asking the following:
    - What are some good strategies to keep in mind while teaching the lessons?
4. After a brief discussion, review the following with the educators.

Page 40

Teaching Tips to Facilitate Learning

- ❖ It is important to be prepared for the lesson. The lesson plan has a list of materials needed for that particular lesson.
- ❖ Avoid presenting the information by reading the text from the flipchart. Learn the information and use the text as a guide. Learners will engage and learn better with eye contact.
- ❖ We want to help participants retain knowledge they gain during the sessions. Therefore, it is important to ask participants questions throughout the sessions about concepts related to genomics that they have already learned about – and to wait for their responses. Through the process of recalling information addressed previously during the sessions, they will develop stronger, more durable memories about genomics (and how to keep their families healthy).[6] It is therefore important to use the question prompts, engage participants in discussion, and have them participate in the activities.
    - o Ask open-ended questions, that is, questions that do not have a yes or no as an answer. For example:
        - What was not clear about this section? *Open ended*
        - Was there something that was not clear in this section? *Closed ended*
- ❖ Set an appropriate pace for learning that fits each learner.
- ❖ Do not assume high literacy levels. This program is designed to fit learners with low literacy levels.
- ❖ Invite other members of the family to learn together (if appropriate).
- ❖ Maximize the learning environment (lighting, distractions, time of day, etc.).
- ❖ Avoid giving additional information not presented in the text (unless provided by the organization).
- ❖ Learners will probably ask questions you cannot answer. That is okay. Do not try to answer questions if you do not know the answer. Let the learner know that you will try to get an answer. Refer to the Frequently Asked Questions guide or ask your supervisor after the lessons.
- ❖ Do not give medical advice.

Keeping Learners Involved

5. Discuss the following questions as a group to help educators identify with the learners and generate ideas of how to engage the learners and keep them for the duration of the program.

   The answers in italics below each question are examples of potential useful comments of what educators may say during the discussion. You may use these to start or add to the conversation, if appropriate. These possible answers in italics are <u>not</u> shown in the Educator Training Manual

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Keeping Learners Involved

It is important to keep learners interested and enthusiastic about the lessons and your visits. Let's discuss how we can achieve this.

Discussion Questions (and possible responses)**:**

1. How do you think that you can keep people interested in participating and finishing the program?
   a. *Keeping commitments*
   b. *Gaining the participant's trust*
   c. *Making the lessons interesting and not monotonous*
   d. *Answering the participant's questions*
   e. *Showing an honest interest in the participant's life*
2. If you were one of the learners, what would help you look forward to a visit from a community educator?
   a. *Learning new science concepts*
   b. *Learning how to integrate science into their daily lives*
   c. *Increasing their self-perception as a science learner*
   d. *Learning more about how to keep themselves and their families healthy*
   e. *A friendly talk that would take me out of my daily routine*
   f. *Helping with other problems that learners share by providing resources, if possible*
3. What kind of information would people be most interested in?
   a. *Other science topics not covered in these lessons*
   b. *More detailed information about the science topics already covered*
   c. *Additional resources for learning science*
   d. *The organization providing this program and its additional resources*
   e. *Learners with limited income may be most interested in information that may suit their immediate needs such as:*
      i. *How to get WIC, SNAP benefits (food stamps), or Medicaid*
      ii. *Where to find food pantries or food banks*

Keeping Learners Involved continued

If learners want to know more about science topics, consider creating a list of useful resources in your community, like children's museums or science centers. For additional information about genetics and genomics, useful websites are also included in page 31 of this manual and in the Frequently Asked Questions document.

In addition, many people may be interested in health-related topics; therefore, they may start asking questions about health topics that educators are not able to answer. If this happens, please direct learners to ask their doctor or healthcare provider. The job of the educator is to maintain the participant's interest in the content of the lessons.

References

1. Livingstone DW. Adults' informal learning: Definitions, findings, gaps and future research. NALL Working Papers. 2001. 21:1-49
2. Cornett CE. What you should know about teaching and learning styles. Fastback 191. Phi Delta Kappa, Eighth and Union, Box 789, Bloomington, IN 47402; 1983.
3. Hristov N, Strohecker C, Allen L, Merson M. Designing for broad understanding of science insights from practice. Integr Comp Biol. 2018 Jul;58(1):113-126.
4. Igartua JJ, Vega Casanova J. Identification with characters, elaboration, and counterarguing in entertainment-education interventions through audiovisual fiction. J Health Commun. 2016 Jan 4;21(3):293-300.
5. Murphy ST, Frank LB, Chatterjee, JS, Baezconde-Garbanati L. Narrative versus nonnarrative: The role of identification, transportation, and emotion in reducing health disparities. J Commun. 2013 Feb;63(1):116-137.
6. Karpicke JD. Retrieval-based learning: Active retrieval promotes meaningful learning. Curr Dir Psychol Sci. 2012;21(3):157-163.

6

SPECIAL SITUATIONS

SPECIAL SITUATIONS

Objectives

- Talk about what child abuse and neglect are and ways to identify them
- Discuss the duties of an educator in cases of suspected child abuse and neglect
- Talk about domestic violence
- Discuss the duties of an educator in cases of suspected domestic violence
- Discuss the housing safety laws and regulations for your state
- Talk about suspected drug abuse and the duties of an educator in suspected cases
- Discuss ways to identify signs of depression and the duties of an educator in suspected cases

Note to facilitator

Please make sure that you know your state's rules and regulations on child abuse and neglect and edit this section in this manual as well as the Educator Training Manual according to your state's requirements.

This section will be mostly useful if educators are teaching outside of your organization's space. Emphasize that you or the program manager/facilitator will be their primary resource for help. In addition, have a list of resources ready that can be utilized in case of a reported child abuse or neglect case.

Child Abuse and Neglect

1. Share the following information with the educators. Depending on your schedule, you may read it to them or have the educators read it on their own time. It is important that they know how to identify and deal with cases of child abuse and neglect.

Page 44

Child Abuse and Neglect

Child abuse is a situation with which you should be familiar when working with families. Although you are not in people's homes as a social service agency or law enforcement official, we all have some responsibility to help children who may be in danger. We will define what constitutes child abuse, and indicate our program's guidelines for dealing with suspected instances. Please keep in mind that the following are guidelines and not policies on how to recognize signs of child abuse and what to do if you come across them.

Child abuse can happen in many different ways, but the result is serious physical or emotional harm. Physical or sexual abuse may be the most striking types of abuse, since they often leave physical evidence behind. However, emotional abuse and neglect are serious types of child abuse that are often more subtle and difficult to spot. The following are signs of child abuse.

- Physical signs**:** Sometimes physical abuse has clear warning signs, such as unexplained bruises, welts, or cuts. While all children will take a tumble now and then, look for age-inappropriate injuries, injuries that appear to have a pattern such as marks from a hand or belt, or a pattern of severe injuries.
- Behavioral signs**:** Signs of physical abuse may be more subtle. The child may be fearful, shy away from touch or appear to be afraid to go home. A child's clothing may be inappropriate for the weather, such as heavy pants and long sleeved shirts on hot days.
- Caregiver signs**:** Physically abusive caregivers may display anger management issues and excessive need for control. Their explanation of the injury might not ring true, or may be different from an older child's description of the injury.

Child neglect is the most frequent form of child abuse. Neglect is a pattern of failing to provide for a child's basic needs or endangering a child's physical and psychological well-being. Child neglect is not always deliberate. Sometimes, a caregiver becomes physically or mentally unable to care for a child, such as in untreated depression or anxiety. Other times, alcohol or drug abuse may seriously impair judgment and the ability to keep a child safe. The result, however, is a child who is not getting their physical or emotional needs met. The following are warning signs of child neglect.

- Physical signs: A child may consistently be dressed inappropriately for the weather, or have ill-fitting, dirty clothes and shoes. They might appear to have consistently bad hygiene, like appearing very dirty, matted and unwashed hair, or noticeable body odor. Another warning sign is untreated illnesses and physical injuries.
- Behavioral signs: Does the child seem to be unsupervised? The child might show troublesome, disruptive behavior or be withdrawn and passive.

2. Share the following on what to do in cases of suspected child abuse or neglect in the same manner as the previous section. Please emphasize to the educators that the following are guidelines and not policies of the program. If your organization has policies on this issue, please insert them in this section. Find out your state's regulations.

Page 45

Reporting Suspected Child Abuse and Neglect

In many states, all adults are mandatory reporters of suspected child abuse or neglect. Remember, it is not your responsibility to decide if something you observe is child abuse or neglect. However, it is your responsibility to report any signs of possible abuse or neglect. Reporting child abuse seems official. Many people are reluctant to get involved in other families' lives. However, by reporting, you can make a tremendous difference in the life of a child and the child's family, especially if you help stop the abuse early. Early identification and treatment can help mitigate the long-term effects of abuse. If the abuse is stopped and the child receives competent treatment, the abused child can begin to regain a sense of self-confidence and trust. Some parents may also benefit from support, parenting training, and anger management. If you ever feel that a child is being abused, contact your supervisor to discuss the situation. She/he will be able to follow-up on the situation.

Suspected Domestic Violence

3. The following information talks about how to identify a suspected case of domestic violence in the same manner as the previous section. Once again, please emphasize to the educators that the following are guidelines and not policies of the program. If your organization has policies on this issue, please insert them in this section.

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Suspected Domestic Violence

Domestic violence is another area with which we should all be familiar. Domestic violence occurs between partners in a relationship. Examples of abuse include:

- Name-calling or putdowns
- Keeping a partner from contacting family or friends
- Withholding money
- Stopping a partner from getting or keeping a job
- Actual or threatened physical harm
- Sexual assault
- Stalking
- Intimidation

If you suspect domestic violence, discuss this with your supervisor and she/he will decide what the best steps are to help that learner in their situation.

Suspected Drug Abuse

4. Share the following information on how to identify a suspected case of drug abuse in the same manner as the previous section. The following are signs and symptoms of drug abuse.
5. Ask educators if they understand all the terms. Provide the educators with simple explanations of the terms if necessary.

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Suspected Drug Abuse

If you suspect that one of your learners or a member of his/her family is using or abusing drugs, report this directly to the supervisor. Some signs or symptoms of drug use are:

- Unusual calmness, unresponsiveness or looking "spaced out"
- Apathy and depression
- Paranoia or delusions
- Temporary psychosis, hallucinations
- Suspected drug paraphernalia such as unexplained pipes, roach clips or syringes
- Lowered threshold for violence
- Abnormally slow movements, speech or reaction time, confusion and disorientation (often seen in users of opiates, benzodiazepines and barbiturates)

If you see these signs and are concerned about one of your learners or a member of his or her family, we will be able to provide them with information about receiving help.

Signs of Depression

6. Present the following information on how to identify a person with signs of depression in the same manner as the previous section. Depression is hard to diagnose, but emphasize to the educators that their job is not to diagnose, but rather, to be aware of the symptoms. If they suspect someone is depressed, direct them to report this suspected case to you or the Program Manager who will be able to link the learner to the services that may help them. The following are signs and symptoms depression.

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Signs of Depression

Depression is an illness that involves the body, mood, and thoughts. It affects the way a person eats and sleeps, feels about himself/herself, and thinks about things. A depressive disorder is not the same as a passing blue mood. Someone with depression usually feels very sad and sometimes does not know the reason why. The following are symptoms/signs of a depressed person:

- Persistent sad, anxious, or "empty" mood
- Feelings of hopelessness or pessimism
- Feelings of guilt, worthlessness, or helplessness
- Loss of interest or pleasure in hobbies and activities that were once enjoyed, including sex
- Decreased energy, fatigue, or being "slowed down"
- Difficulty concentrating, remembering, or making decisions
- Insomnia, early-morning awakening, or oversleeping
- Appetite and/or weight loss, or overeating and weight gain
- Thoughts of death or suicide; suicide attempts
- Restlessness or irritability

If you suspect that a participant of yours is depressed, report this to the supervisor. Although you are not there to identify medical conditions of the learners, if we see that they need other services, we want to link them to the services that may help them.

7

APPENDICES

Appendix 1

Setting Up and Using the Microscope and Slides

Original microscope used in the intervention was the 40X-2000X Binocular Microscope with Mechanical Stage, purchased from AmScope.com. The link to this microscope is the following: https://amscope.com/collections/student-microscopes-high-power-compound/products/b100b-ms

Any other microscope with same magnification will be sufficient. These instructions can be used for most microscopes.

1. Plug in the microscope and turn on the light source using the power switch near the bottom of the microscope.
2. Make sure the objective labeled "4/0.10" (with the red line) is in the back position, directly over the window in the bottom of the stage. If not, rotate the nosepiece until the 4/0.10 objective is in the back.
3. Use the coarse focus knob to move the stage up to its highest position. (Start to get used to which way to turn the focus knob to move the stage up and down.)
4. Open the spring-loaded side of the mechanical stage, and insert the slide as far as it will go.
5. Use the mechanical stage knobs to move the slide left/right and towards/away from you, until the area of interest on the slide is in the light coming up through the stage.

6. Look through the eyepieces, and adjust the stage *away* from the objective slowly until the cells are in focus. Use the Fine Focus as needed. This makes fine adjustments. You may also use the mechanical stage knobs to move the slide to see different cells. *Note: The slide will not come into contact with the 4/0.10 objective, even at the stage's highest point. However, with the higher magnification objectives, the slide may come into contact with the objectives, possibly causing damage. This is why you should always move the stage away from the objectives when focusing, especially with the course focus.*
7. Once the cells are in focus, rotate the nosepiece so that the 10/0.25 objective is in the back position. Look through the eyepieces and re-focus as needed. To re-focus, use the fine focus knob at first. If you need to use the course focus knob to do this, start by moving it so the stage moves down. If you need to move the stage up with the course focus knob, do so carefully and do not touch the slide to the objective. Use the mechanical stage knobs to move the slide to see different cells.

8. Once the cells are in focus, rotate the nosepiece again, so that the 40/0.65 objective is in the back position. There will be very little space between the slide and the objective at this point. Look through the eyepieces and re-focus as needed. Use the fine focus knob at first, and only use the course focus if necessary. Again, if you need to use the course focus knob, be very careful not to the slide touch the objective.

9. To examine a different slide, turn the nosepiece until the 4/0.10 objective is in the back, carefully remove the slide and replace with a new one. Follow the same instructions to increase magnification from the 40/0.10 to 10/0.25 and 40/0.65.

10. When finished, rotate the nosepiece until the 4/0.10 objective is in the back and remove the slide. Turn off the power and unplug the microscope. The light source will be very hot, so be careful not to touch it, and let it cool before storing.

Appendix 2

Setting Up the Microscope Wireless Camera

Original microscope wireless camera used in the intervention was the 720p Wi-Fi Microscope Digital Camera + Software from AmScope.com and can be found in the following link:

https://amscope.com/products/wf100#product_tabs_description_tabbed

The camera works with Windows, Mac, and Linux. It acts as a wireless access point, allowing you to connect remotely using standard Wi-Fi. It has specialized microscopy software that can be installed on your laptop or desktop computer so you can connect to the camera for a live image from your microscope. Other wireless or wired cameras that can project onto a tablet/computer screen are also available.

Follow the steps below to connect the camera:

1. Plug the camera unit into a power outlet to turn it on (there is no on/off switch).
2. To connect the iPad or table to the camera, go to "Settings" and then "Wi-Fi." The camera will show up as "WF100," so click on that as the Wi-Fi network. (When connected to the camera, the iPad will not be connected to another Wi-Fi network.)
3. On the iPad, downloand and open the Toupview app. Click on the square with the camera number.
4. When you would like to show what is being seen on the microscope slides on the iPad, remove one of the two microscope eyepieces and carefully set it aside. Remove the cover from the camera lens (if present), and carefully insert the camera into the slot for the removed eyepiece. You should be able to see the microscope view on the iPad. Note: movements and focusing will be a little delayed on the iPad.
5. Once you are finished using the camera, remove it from the eyepiece slot, and replace the eyepiece into the microscope.

Appendix 3

Recommended Cell Slides

Mammal neurons – In the following link you can find slide contains mammalian nerve cells (neurons) and the various parts of the cells, such as the nuclei, axons, and dendrites (not covered in the lessons), can be identified. Please note that the small glial cells (tiny dots) can be identified in the nervous tissue smear but are also not covered in the lessons.

> https://www.carolina.com/histology-microscope-slides/mammal-giant-multipolar-neurons-slide-smear-luxol-fast-blue/313570.pr

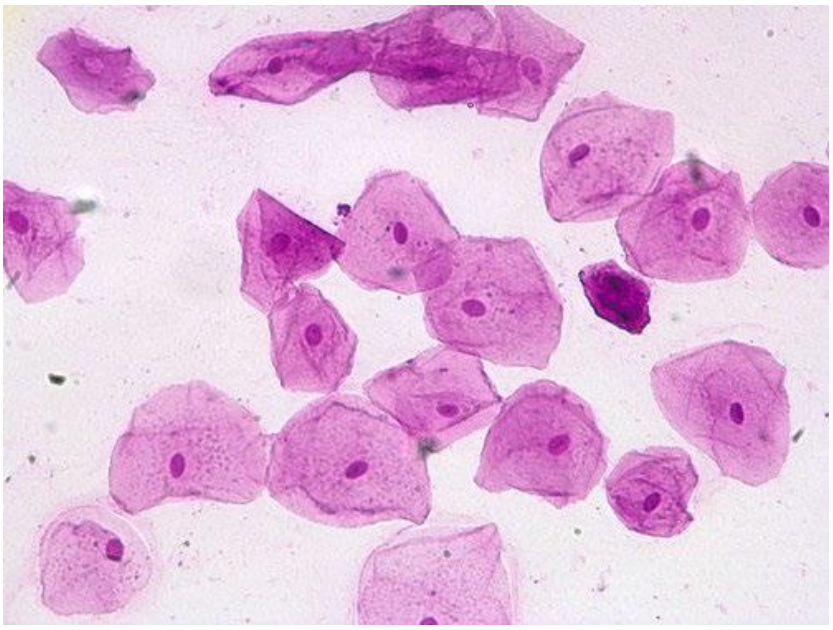
The next link directs you to a set of cell slide set containing six different slides from the human body or another mammal. Represented are bone, blood, hair, cheek cells, muscle, and skin.

> https://www.carolina.com/basic-science-microscope-slides/all-about-me-microscope-slide-set/311960.pr

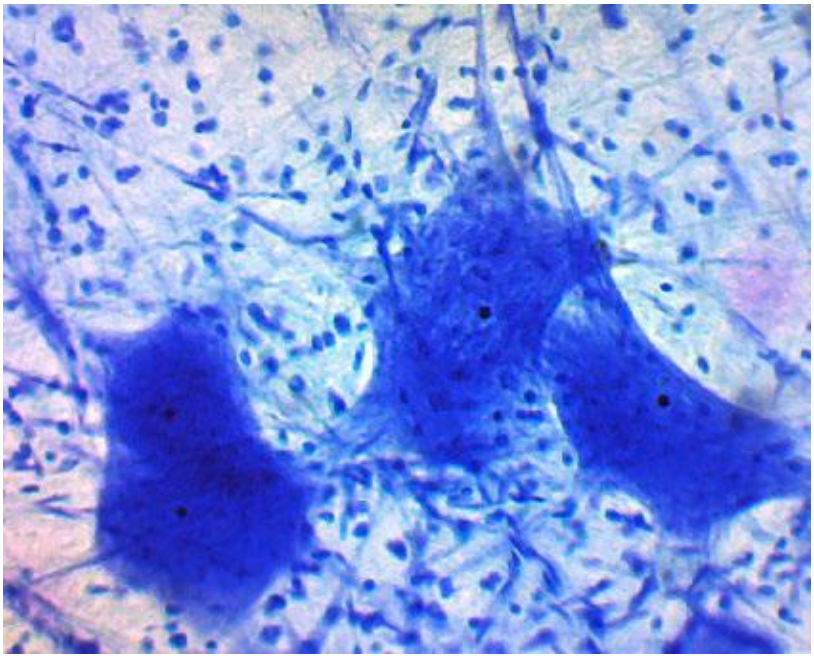
Appendix 4

Printed Cell Images

Cheek cells



Neurons



Appendix 5

DNA Model

Note: If you are using a different DNA model than the one suggested, please make sure you are able to demonstrate what mutations are (i.e., bases are removable). The suggested DNA model is a three-foot long strand of DNA that demonstrates the twisted ladder-like arrangement of DNA.

The suggested DNA model can be purchased from: https://www.flinnsci.com/dna-model/fb1127/

Modification for mutations (if you are purchasing the recommended DNA model)

The DNA model comes with all of the base pairs affixed. To create a modified DNA model with a removable base pair, you should:

- Unscrew one of the base pairs from the model (preferably not the first or last for stability).
- Use a strong glue to attach a round piece of Velcro to both ends of the base pair wooden dowels. Attach the opposite Velcro piece to the DNA model where the base pair originally attached.
- You will need to purchase a wooden dowel and acrylic paint. The wooden dowel should be 2.5" circumference and at least 5" length.
- Cut the wooden dowel to 5" length, if necessary, and paint half with each paint color purchased.
    - If you removed a red and blue base pair from the original model, you will need to buy the green and orange paint colors. If you removed the orange and green base pair, you will buy the red and blue.
- Finally, attach Velcro piece to the end of the new base pair (now painted) to connect it to the DNA model.

Appendix 6

Cell Communication Model

Items needed:

- Paper bowls to represent nerve cell endings
- Small marshmallows to represent the signals that cells use to communicate
- Black construction paper to represent lead
- Large plastic container (to contain the marshmallows/beads)

Note: marshmallows were used to prevent choking hazards. If your organization will not have small children present, marshmallows could be replaced (for sanitary purposes) by marbles, or beads…etc.

Directions:

1. Place one paper bowl upside down and cut three holes like the picture below. You will need two bowls per set.
    a. Note: the original intervention painted the bowls green so participants could relate bowls to the green cell images in the flipchart. This is not necessary, but encouraged. To paint them, use green acrylic and paint the bottom sides of the paper bowls using a small brush.
2. Cut small pieces (about 2" x 2") and fold them. These should be able to cover the holes in the paper plate without falling through.

Appendix 7

Pipe Cleaner DNA Models

Items needed for one pair of DNA models:

- Two 6.5 ft. giant chenille pipe cleaners in white and two in black . These can be found in craft stores such as Michaels or online.
- Green, orange, and blue fabric paint (spray or acrylic will also work). As an alternative to painting the pipe cleaners, green, orange, and blue colored chenille pipe cleaners can be purchased and cut to 1/3 and joined.
- Gloves
- Two bag clips. The butterfly types work best. 

Directions:

1. Using gloves, paint a little less than one third of a white pipe cleaner with the green paint.
2. Paint a little less than one third of a white pipe cleaner with the orange paint.
3. Paint the final third of the white pipe cleaner blue. Let dry.
4. Repeat steps 1-3 with the second white pipe cleaner.

   Note: each of the colors represents a different gene and the order of the colors will match the video images.

5. Once the painted pipe cleaners have dried, twist the black and painted pipe cleaners around each other as the picture below.

6. Finally, coil the twisted pipe cleaners to make a spring like shape like the picture below.

   Note: the DNA double helix is represented by the twisted white (but painted) and black pipe cleaners. The twisted strand is then coiled to represent how DNA is stored in the nucleus (histones are not shown for simplicity).

Appendix 8

Risk Puzzle

Instructions: Print and cut pieces. It is recommended to use cardstock paper and to laminate pieces if they will be used multiple times.

Appendix 9

BPA Activity

Instructions: Print and cut pieces. It is recommended to use cardstock paper and pieces be laminated if they are to be used multiple times.

Appendix 10

Lead Containers Activity

Items needed for containers activity:

- A clear glass container such as a bowl or cup
- A ceramic container such as a bowl or mug
- A glazed pottery container such as a bowl or cup
- Red cardstock or construction paper
- Green cardstock or construction paper

Directions:

1. Cut a 4 inch by 4 inch square from the green construction paper.
2. Cut a 4 inch by 4 inch square from the red construction paper.
3. It is recommended to laminate pieces if they will be used multiple times.

Glass

Ceramic

Glazed pottery

Appendix 11

BPA Containers Activity

Items needed for BPA containers activity:

- A clear glass container such as a bowl or cup
- A ceramic container such as a bowl or mug
- A glazed pottery container such as a bowl or cup
- A plastic that does not indicate BPA-free
- A BPA-free plastic container
- A silicone container such as a bowl or storage container
- A stainless steel cup or mug

Silicone

Stainless steel

Glass

Ceramic

Plastic

Glazed pottery

Appendix 12

Sugar Tubes Activity

Items needed for one set of test sugar tubes:

- 15 plastic test tubes with caps, 16x150mm (25ml capacity). These are inexpensive and easily found online.
- Sugar
- Kitchen scale
- Rubber bands
- Laminating sheets
- Optional: small labels

Directions:

1. Print the images in the next page and laminate them.
2. Add the following amounts of sugar to test tubes and close the cap(s):
    a. Apple jacks: 17 grams
    b. Plain Cheerios: 1 gram
    c. Apple: 5 grams
    d. Hi-C juice: 30 grams
    e. Chocolate bar: 24 grams
    f. Small Chips Ahoy cookies: 13 grams
    g. Coke can: 40 grams
    h. Coke 20oz bottle: 67 grams
    i. Apple juice: 24 grams
3. Use a rubber band to tie test tubes together for items with multiple test tubes.
4. Optional –label each test tube with the quantity of sugar in grams or teaspoons.

1 cup of Apple Jacks

1 cup of plain Cheerios

8 oz. Hi-C juice

One apple

Chocolate bar

2 Small Chips Ahoy! cookies

Coca Cola 12oz

Coca-Cola 20oz

1 Cup of apple juice

Appendix 13

Frequently Asked Questions

Cells, DNA, genes, and mutations

1) What is DNA?

DNA contains the instructions for creating and continuing everything our bodies do. It is in all parts of our bodies, so doctors can use blood, skin, and cheek brushings to look at DNA. DNA has four building blocks or bases, which we call A, C, G, and T.

2) What are genes?

Genes are made up of sections of DNA. DNA is so small that it cannot be seen, even with a microscope. DNA is made up of smaller pieces, which we call "bases." There are four different types of bases. The specific pattern of these bases makes up specific genes. The bases are linked together to form DNA, similar to links in a chain (show DNA model.)

Genes provide the instructions for making proteins the cell needs. Genes can be "read" by the cell. The order in which the bases (A, C, G, and T) are linked determines which protein each gene makes. Proteins carry out the work of the cell. Proteins allow cells to do what they are supposed to do.

3) What is the difference between genes and DNA?

DNA contains the instructions for creating and continuing everything our bodies do. DNA is in all parts of our bodies, so doctors can use blood, skin, and cheek brushings to look at DNA. DNA has four bases, which we call A, C, G, and T.

Genes are made up of sections of DNA. Their functions are determined by the sequence of the bases A, C, G, and T. Genes provide the instructions for making proteins the cell needs.

4) What do genes actually do?

The primary way cells get their instructions are through proteins. Proteins allow cells to do what they are supposed to do. Genes provide the instructions for making proteins. Genes can be "read" by the cell. The specific order in which the basic units of DNA ("bases" are referred to as A, T, C, and G) determine which protein each gene makes. If a change is made to a gene that provides instructions to create a specific protein, then that protein may also be changed. This is how mutations can cause cells to function abnormally. The changes that alter the order of bases in genes are called mutations.

5) Does each cell have about 25,000 different genes?

Each cell contains the same 25,000 genes, but each cell only uses a specific set of genes that tell the cell how to function. The other genes are essentially turned off. Cells can turn on or turn off genes at certain times. Each cell only makes what it needs to function correctly. For example, in nerve cells, only genes that are important for nerves are turned on (like those used to send signals to each other and muscles). Other genes, like those important for skin cells, are turned off in nerve cells.

6) **What makes different cells in the body behave differently?**
Each cell in the body performs a specific job. For example, cells in the heart act in a certain way that makes the heartbeat. All of the cells in a person's body have the same DNA. This DNA is unique to each of us. But different genes are turned "on" in different types of cells. Only the genes that the cell needs to do its job are turned "on." All other genes are turned "off." So, even though a person's different cells have the same genes in them, some genes are turned on and others are turned off.

7) **Do blood cells have nuclei?**
Red blood cells do not have nuclei or DNA, but white blood cells do. Red blood cells move oxygen around in the body. White blood cells have many functions, such as helping our bodies fight infection. When doctors conduct genetic tests through blood, they use the white blood cells to get someone's DNA.

8) **What are chromosomes?**
Almost all cells have DNA. DNA is located in a compartment or section of the cell called the nucleus. Inside the nucleus, each chain of DNA is wrapped tightly into a structure called a chromosome. The cells in our bodies have 23 pairs, or 46 total, chromosomes. Twenty-three of these came from our mother, and 23 from our father.

9) **Do the sperm and egg also have all of our DNA**?
Sperm and eggs only have 23 chromosomes each, (½ of the DNA from each person). When fertilization occurs, the sperm and the egg fuse together. This creates a new cell with all of the 46 necessary chromosomes, 23 from the father's sperm and 23 from the mother's egg.

10) **Do genes change over time?**
Normally, the actual sequence of the bases in DNA that makes up each gene does not change over time. Sometimes, however, changes called mutations can change a part of the gene. This mutation can change the instructions and can make the cells behave differently. Many times these mutations do not cause a problem. But sometimes the mutations can lead to diseases, like cancer. Mutations can sometimes occur on their own. But mutations are more common when the cells are exposed to certain chemicals. Some of the chemicals found in tobacco smoke can cause mutations.

In addition, the way genes work changes over time for a number of reasons. As we get older, our gene function can change. Genes can also change because of our surrounding environment, such as our diet, chemicals we may be exposed to, or even some behaviors. Changes that affect how the genes function but do not change the DNA sequence are called epigenetic changes.

11) **Can mutations that were caused during my lifetime be passed down to my children?**
Most of the mutations that we acquire during our lifetimes are not passed down to our children. It is possible that some mutations may occur in your cells that make sperm (for males) or eggs (for females). Those mutations may be passed down to your children.

12) Why do some mutations cause harm and others do not?

Whether a mutation is harmful or not depends on what part of the DNA is damaged. Damage to some sections of the DNA does not change what cells do. Some damages make cells grow without having the ability to stop, as they normally would. This unregulated growth can lead to cancer.

While all of our DNA is important, some parts are more important than others. Only about 2-3% of the DNA actually encodes for a protein (see question 2-4 for information about proteins), therefore most of the time, mutations will occur outside of a region that has the information to make proteins (even within a gene, since a gene includes some portions that are not ever used/read to make a protein). Many of the regions do not actually encode for proteins; however, they can still play a role in how certain genes are read. Therefore, you can also have mutations that are NOT inside the genes that can still cause problems.

13) Why are the cells in the slide different colors?

The cells in the slides you used were dyed with special stains. These special stains make it easier for you to see them through the microscope. Most cells in slides are not naturally those colors.

14) How small and how big can genes be (in terms of base pairs)?

Genes are made up of base pairs. Some genes may have only a few hundred base pairs, while the biggest may have just over 2 million base pairs. Most genes are probably around 15-20 thousand base pairs.

Heredity

15) When the sperm and egg fuse to form an embryo, will not the new cell have too much DNA/chromosomes/genes?

The cells that make the sperm in males and eggs in females go through a special process to divide the amount of genes and DNA in half. Each sperm and egg only have half the genes from each parent. In other words, each sperm or egg only has 23 chromosomes. An embryo needs 46 to form correctly. When fertilization between the egg and sperm happens, the new embryo has the correct number of genes (and correct number of chromosomes).

16) Why do we get some traits from our mother and some from our father?

We all get exactly half of our DNA from each of our parents. For every gene, we get one copy from our mother and one from our father. All the genes that we get from each parent are mostly the same but have some differences, or variations. Those differences are what make each person different. Sometimes the gene we inherit from one parent is more dominant than the one we inherit from the other parent. Then we are more likely to have the trait that is controlled by that more dominant gene.

17) Which parents' genes have the strongest effect?

Some versions of specific genes are more dominant than that of the other versions. It is the version of the specific gene that matters, not which parent the gene comes from. Some children may show more of their mother's genes, while other children of the same parents may show more of the father's genes.

18) Do daughters get more genes from their mother or father? How about sons?

For the most part, the child's sex does not affect which genes they get from their mother or father. All children get half of their genes (randomly mixed) from their mother and half from their father.

19) Can a mother influence what genes the child will have during her pregnancy?

No. Traits, such as the color of their eyes, are only determined by genes that come from parents.

20) How do identical twins have the exact same DNA/genes?

When a baby is made, one sperm and one egg fuse together to make a single cell. This is called fertilization, or conception. This cell divides over and over, forming a group of cells. Each cell in this group has the exact same genes and DNA. Identical twins are formed when one group of cells formed after the fertilization of one egg with one sperm splits in two. These two new groups of cells are now identical to each other and will form into identical twins. Identical twins may develop in utero in two different placentas or in one single one.

21) Why do fraternal twins look different from each other?

Usually, the mom releases only one egg each month. Sometimes, but rarely, the mom releases two eggs at once. If this happens, two different sperm can fertilize those different eggs. When this happens, two babies will develop at the same time. Each baby will inherit from the parents a different mix of genes. These babies will therefore be fraternal twins. The genes from fraternal twins are just as similar as any other brother or sister.

Identical twins can also look different, especially as they get older. These changes are because of different behaviors (for example, smoking, diet, and exercise) or different environmental exposures.

Epigenetic changes

22) Do all exposures that affect DNA cause epigenetic changes?

No. There are other ways that different chemicals or other exposures in our environment can cause changes to DNA. Mutations change the sequence of the bases in DNA (the A's, C's, G's, and T's). Mutations are different from epigenetic changes.

23) How can I tell if an exposure will affect (or has affected) my genes?

Scientists are trying to learn more about that now. There is not a way for you to tell if an exposure will affect (or affected) your genes. In addition, not all epigenetic changes make it more likely you might develop a disease. Some epigenetic changes can be beneficial.

24) If one of my parents has a genetic mutation for a disease, will I get that disease?

The risk of getting the same disease depends on a number of things, and may not be straightforward. For some genetic diseases, you only need to inherit one bad copy of the gene to have the disease. For other diseases, you need to inherit bad copies of the gene from both parents. For more common diseases like diabetes and some heart problems, many different genes are involved, making it difficult to determine your risk. If one of your parents has a genetic related disease, it is important for you to schedule a visit with a physician to determine your risk. He or she may refer you to a Clinical Geneticist for additional follow-up.

25) Does a gene open or close completely with epigenetic changes?

Genes are not usually completely turned on or off, but how they are read to give the cell instructions vary. Epigenetic changes can open the DNA wider or close it tighter to control how much it will be read (to make a protein). If the gene is a little more open, then a little more of that gene will be read.

Environmental exposures

26) Is vaping bad?

Electronic cigarettes are dangerous. Scientists are still learning about their short and long-term health effects. They do know that using electronic cigarettes are not safe for anyone to use. Most e-cigarettes contain nicotine and other substances that harm the body. Do not use e-cigarette, or vaping, products.

27) Is secondhand smoke from vaping bad?

Scientists are still learning about the health effects from secondhand smoke that comes from electronic cigarettes. There is some evidence that suggests that it is important to avoid exposure to e-cigarette vapor.

28) Is secondhand smoke from marijuana also bad as is tobacco secondhand smoke?

Secondhand marijuana smoke contains harmful chemicals, including some of the same toxic chemicals in smoked tobacco. Smoked marijuana has many of the same cancer-causing substances as tobacco secondhand smoke. Scientists are still learning about secondhand marijuana smoke and its impact health.

29) How safe are synthetic sweeteners, especially stevia plant products?

Scientists are still learning about the health effects from synthetic sweeteners. We are suggesting that you reduce your sugar consumption by eating whole foods—fruits, vegetables, etc. If you are still eating "sweet" foods, even with artificial sweeteners, then you are not getting the other benefits of whole foods (e.g., vitamins, minerals, proteins). For that reason, it is best to avoid these unless you are told to use them by a doctor or nutritionist.

30) What resources does the county health department have for testing for lead?

If someone is concerned about having lead in paint (doors, windows, exterior or interior walls), they need to contact their doctor and see if child under six has been or can be tested.

31) Is lead absorption the same for children and adults?

No. Lead is absorbed more easily by children than adults.

Appendix 14

Educator Tool box

LCEs should have all the materials ready prior to each lesson. The list below is just an example of what could be needed and was originally used during the original intervention.

1. A folder or small file box to carry necessary paperwork
2. Note pad
3. Pencils/pens
4. A carrying case/cart to carry flipchart, microscope and other hands-on activities
5. A list of most commonly needed resources in your area, such as food pantries, free or reduced cost clinics, translation services, etc.
6. Hand sanitizer

Appendix 15

Additional Environmental Resources

Secondhand smoke CDC Spanish and English infographics:

- Tobacco use and secondhand smoke exposure is high in multiunit housing. National Center for Chronic Disease Prevention and Health Promotion (U.S.). Office on Smoking and Health. Published Date: 07/12/2016. URL: https://stacks.cdc.gov/view/cdc/61691
- El consumo de tabaco y la exposición al humo de segunda mano son altos en las viviendas de múltiples unidades. National Center for Chronic Disease Prevention and Health Promotion (U.S.). Office on Smoking and Health. Published Date: 11/21/2016 URL : https://stacks.cdc.gov/view/cdc/61690

Lead English and Spanish Childhood Lead Poisoning Prevention lead infographics. North Carolina Healthy Homes. https://nchealthyhomes.com/lead-poisoning/

This source contains the following:

- Prevent childhood lead
- Lead in pregnancy
- Short term actions to prevent exposures to lead
- Cleaning up lead dust
- Lead in spices
- Keeping lead at work

BPA Spanish and English infographics. Silent Spring Institute. Tip Sheets: 6 Simple Steps to Avoid BPA and Phthalates in Food

https://silentspring.org/sites/default/files/page-basic/2020-02/6%20simple%20tips%20to%20avoid%20BPA%20and%20phthalates_spanish.pdf

Nutrition. American Heart Association. Eat smart English and Spanish infographics.

English: https://professional.heart.org/en/healthy-living/healthy-living-infographics

Spanish: https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/healthy-living-spanish-infographics

This source contains the following:

- Sugar infographics
- Nutrition label facts infographics

- Eating fresh foods infographics
- Good and bad fats infographics
- Protein infographics
- Sodium infographics

Columbia Center for Children's Environmental Health Spanish and English infographics. Center Health Education Materials. Spanish and English infographics. https://www.publichealth.columbia.edu/research/columbia-center-childrens-environmental-health/center-health-education-materials

This source contains the following:

- BPA infographics
- Eating fresh foods infographics
- Healthy Home, Healthy Child activity book
- Protect Your Children from Pesticides infographics
- IPM (integrated pest management) Pesticides infographics

Appendix 16

Learner Follow-Up Sheet

Nombre y número de teléfono (*Name, phone number*)	**Fecha de Lección 1** (*Lesson 1 date*)	**Fecha de Lección 2** (*Lesson 2 date*)	**Fecha de Lección 3** (*Lesson 3 date*)	**Fecha de Lección 4** (*Lesson 4 date*)	**Fecha de Lección 5** (*Lesson 5 date*)