

# **Unit 2: An Introduction to Genes and Genomes (Life Science) Copied from: Biotechnology (Life Science), Copied on: 02/21/22**

Content Area: **Science**  
Course(s): **Biotechnology**  
Time Period:  
Length: **20 days, Grade 10 Academy**  
Status: **Published**

## **Title Section**

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### **Department of Curriculum and Instruction**



**Belleville Public Schools**

**Curriculum Guide**

**BIOTECHNOLOGY, GRADE 10 ACADEMY**

**AN INTRODUCTION TO GENES AND GENOMES**

**Belleville Board of Education**

**102 Passaic Avenue**

**Belleville, NJ 07109**

Prepared by: **TEACHER OF BIOLOGICAL SCIENCES, PAUL AIELLO**

Dr. Richard Tomko, Ph.D., M.J., Superintendent of Schools

Ms. LucyAnn Demikoff, Director of Curriculum and Instruction K-12

Ms. Nicole Shanklin, Director of Elementary Education K-8, ESL Coordinator K-12

Mr. George Droste, Director of Secondary Education

Board Approved: September 23, 2019

## **Unit Overview**

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Encoded within DNA are genes that provide instructions controlling the activities of all cells. Genes enable the inheritance of traits from generation to generation. Genes influence our behavior; determine our physical appearances, such as skin, hair, and eye color; and can cause or be affected by genetic disease.

## **Enduring Understanding**

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Central to the study of biotechnology is an understanding of the structure of DNA as the molecule of life- the inherited genetic material. In this chapter we review DNA structure and replication, discuss how genes code for proteins, provide an overview of genomics, and consider causes and consequences of mutations. In this chapter there are many exciting potential future developments especially related to genomics.

## **Essential Questions**

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What are the important differences between DNA and RNA?

What major differences exist between Prokaryotes and Eukaryotes?

What is gene expression regulation?

What are the 3 types of RNA and what are their functions?

What is CRISPR-Cas and why is it important?

## **Exit Skills**

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AFTER COMPLETING THIS CHAPTER, STUDENTS SHOULD BE ABLE TO:

Compare and contrast prokaryotic and eukaryotic cells

Describe the structure of a nucleotide and explain how nucleotides form double-helical DNA molecules

Explain the process of DNA replication and discuss the role of key proteins involved

Understand what genomes are and why biologists study them

Describe the process of transcription and understand how mRNA processing creates a functional mRNA molecule

Describe the process of translation, and understand the roles of mRNA, tRNA, and rRNA.

Explain why noncoding RNAs are important to cells

Explain why gene expression regulation is important, and be familiar with the different processes involved in regulating gene expression

Name different types of mutations and give examples of the consequences of mutations

Explain why the scientific community is excited about CRISPR-Cas applications in biotechnology

Appreciate why the epigenome is of interest to scientists in biotechnology

## [NextGen Science Standards](#)

|                       |   |
|-----------------------|---|
| 9-12.HS-LS1-1         | Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.   |
| 9-12.HS-LS1-1.6.1     | students investigate systems by examining the properties of different materials, the structures of different components, and their interconnections to reveal the system's function and/or solve a problem. They infer the functions and properties of natural and designed objects and systems from their overall structure, the way their components are shaped and used, and the molecular substructures of their various materials. |
| 9-12.HS-LS1-1.LS1.A.2 | All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells.  |

## **Interdisciplinary Connections**

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|                   |  |
|-------------------|--|
| LA.RH.11-12.2     | Determine the theme, central ideas, information and/or perspective(s) presented in a primary or secondary source; provide an accurate summary of how key events, ideas and/or author's perspective(s) develop over the course of the text.   |
| LA.RH.11-12.3     | Evaluate various perspectives for actions or events; determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain.  |
| LA.WHST.11-12.1.B | Develop claim(s) and counterclaims using sound reasoning and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases. |
| LA.WHST.11-12.6   | Use technology, including the Internet, to produce, share, and update writing products in response to ongoing feedback, including new arguments or information.  |

## **Learning Objectives**

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- Compare and contrast prokaryotic and eukaryotic cells
- Describe the structure of a nucleotide and explain how nucleotides form double-helical DNA molecules
- Explain the process of DNA replication and discuss the role of key proteins involved
- Understand what genomes are and why biologists study them

- Describe the process of transcription and understand how mRNA processing creates a functional mRNA molecule
- Describe the process of translation, and understand the roles of mRNA, tRNA, and rRNA.
- Explain why noncoding RNAs are important to cells
- Explain why gene expression regulation is important, and be familiar with the different processes involved in regulating gene expression
- Name different types of mutations and give examples of the consequences of mutations
- Explain why the scientific community is excited about CRISPR-Cas applications in biotechnology
- Appreciate why the epigenome is of interest to scientists in biotechnology

**Action Verbs:** Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

| Remember  | Understand    | Apply       | Analyze       | Evaluate  | Create      |
|-----------|---------------|-------------|---------------|-----------|-------------|
| Choose    | Classify      | Choose      | Categorize    | Appraise  | Combine     |
| Describe  | Defend        | Dramatize   | Classify      | Judge     | Compose     |
| Define    | Demonstrate   | Explain     | Compare       | Criticize | Construct   |
| Label     | Distinguish   | Generalize  | Differentiate | Defend    | Design      |
| List      | Explain       | Judge       | Distinguish   | Compare   | Develop     |
| Locate    | Express       | Organize    | Identify      | Assess    | Formulate   |
| Match     | Extend        | Paint       | Infer         | Conclude  | Hypothesize |
| Memorize  | Give Examples | Prepare     | Point out     | Contrast  | Invent      |
| Name      | Illustrate    | Produce     | Select        | Critique  | Make        |
| Omit      | Indicate      | Select      | Subdivide     | Determine | Originate   |
| Recite    | Interrelate   | Show        | Survey        | Grade     | Organize    |
| Select    | Interpret     | Sketch      | Arrange       | Justify   | Plan        |
| State     | Infer         | Solve       | Breakdown     | Measure   | Produce     |
| Count     | Match         | Use         | Combine       | Rank      | Role Play   |
| Draw      | Paraphrase    | Add         | Detect        | Rate      | Drive       |
| Outline   | Represent     | Calculate   | Diagram       | Support   | Devise      |
| Point     | Restate       | Change      | Discriminate  | Test      | Generate    |
| Quote     | Rewrite       | Classify    | Illustrate    |           | Integrate   |
| Recall    | Select        | Complete    | Outline       |           | Prescribe   |
| Recognize | Show          | Compute     | Point out     |           | Propose     |
| Repeat    | Summarize     | Discover    | Separate      |           | Reconstruct |
| Reproduce | Tell          | Divide      |               |           | Revise      |
|           | Translate     | Examine     |               |           | Rewrite     |
|           | Associate     | Graph       |               |           | Transform   |
|           | Compute       | Interpolate |               |           |             |
|           | Convert       | Manipulate  |               |           |             |
|           | Discuss       | Modify      |               |           |             |
|           | Estimate      | Operate     |               |           |             |
|           | Extrapolate   | Subtract    |               |           |             |
|           | Generalize    |             |               |           |             |
|           | Predict       |             |               |           |             |



## Suggested Activities & Best Practices

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Read Chapter 2 pages 29-59

Complete Questions on page 58 & 59

Complete activities on DNAi.org

Watch THE DNA REVOLUTION video

## **Assessment Evidence - Checking for Understanding (CFU)**

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Completion of worksheets at DNAi.org (Formative)

Answers to questions on pages 58&59 (Formative)

Discussion after DNA REVOLUTION video (Formative)

Quizzes/ Chapter Test (Summative)

Benchmark #1(Benchmark)

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light

- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

## **Primary Resources & Materials**

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**PRIMARY RESOURCES:** Introduction to Biotechnology, 4th ed. 2019(text book)

## **Ancillary Resources**

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Introduction to Biology Companion Website: [www.pearsonhighered.com/biotechnology](http://www.pearsonhighered.com/biotechnology)

Activities from DNAi.org

THE DNA REVOLUTION video

Internet

myDNA @ DNAi.org

## **Technology Infusion**

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Chromebooks and internet for research

Pearson companion website

Science Direct search engine

MYDNAi.org



## Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts  
Photostory 3  
Kid Story Builder  
Music Maker Jam  
Paint A Story  
Office 365  
MS PowerPoint  
Stack 'Em Up  
NqSquared Numbers  
Physamajig  
Xylophone 8

Wikipedia  
Skydrive  
Lync  
SkyMap  
Skype  
Office 365  
Puzzle Touch  
Easy QR  
Memorylage  
Life Moments  
Word Cloud Maker

Where's Waldo?  
MS Excel  
Flipboard  
Office 365  
Nova Mindmapping

Ted Talks  
Record Voice Pen



## Alignment to 21st Century Skills & Technology

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|                   |  |
|-------------------|--|
| CRP.K-12.CRP1     | Act as a responsible and contributing citizen and employee.  |
| CRP.K-12.CRP1.1   | Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.  |
| CRP.K-12.CRP2     | Apply appropriate academic and technical skills.   |
| CRP.K-12.CRP2.1   | Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.  |
| CRP.K-12.CRP10    | Plan education and career paths aligned to personal goals.   |
| CRP.K-12.CRP10.1  | Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals. |
| CRP.K-12.CRP11    | Use technology to enhance productivity.  |
| CRP.K-12.CRP11.1  | Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.   |
| CRP.K-12.CRP12    | Work productively in teams while using cultural global competence.   |
| CRP.K-12.CRP12.1  | Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.   |
| CAEP.9.2.12.C.1   | Review career goals and determine steps necessary for attainment.  |
| CAEP.9.2.12.C.2   | Modify Personalized Student Learning Plans to support declared career goals.   |
| CAEP.9.2.12.C.6   | Investigate entrepreneurship opportunities as options for career planning and identify the knowledge, skills, abilities, and resources required for owning and managing a business.  |
| CAEP.9.2.12.C.7   | Examine the professional, legal, and ethical responsibilities for both employers and employees in the global workplace.  |
| TECH.8.2.12.A.CS3 | The relationships among technologies and the connections between technology and other  |

|                   |  |
|-------------------|--|
|                   | fields of study.   |
| TECH.8.2.12.B.3   | Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs. |
| TECH.8.2.12.B.CS1 | The cultural, social, economic and political effects of technology.  |
| TECH.8.2.12.B.CS2 | The effects of technology on the environment.  |

## **21st Century Skills/Interdisciplinary Themes**

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Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please list only the **21st Century/Interdisciplinary Themes** that will be incorporated into this unit.

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

## **21st Century Skills**

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Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please list only the **21st Century Skills** that will be incorporated into this unit.

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

## **Differentiation**

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Small Group Instruction- Students will work in groups of 4 to answer questions and internet searches on page 58 & 59

Visual Presentation- power point given with notes for this section

**Differentiations:**

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

**Hi-Prep Differentiations:**

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products

- Varying organizers for instructions

#### **Lo-Prep Differentiations**

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

### **Special Education Learning (IEP's & 504's)**

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Provide modifications as dictated in the student's IEP/504 Plan to encourage RNA and protein synthesis understanding

Students working with Assigned Partner for group questions on page 58 & 59 and DNAI.org activities

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation

- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

## **English Language Learning (ELL)**

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Google Translate allowed in room and using MY DNA website

Sit student with bilingual partner of same language to work on regulation of gene expression and protein synthesis

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarify
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

## **At Risk**

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Tutoring by Peers: ask for help with questions on pages 58 & 59

Using videos, illustrations, pictures, and drawings to explain or clarify Types of mutations on their consequences

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

## **Talented and Gifted Learning (T&G)**

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Complete an extra lab activity on Protein synthesis, tracing Transcription and Translation

Complete Case Study on Page 59

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor

- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

## **Sample Lesson**

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See Sample in Unit 1.