

**CAREER  
PATHS**

Virginia Evans  
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# GENETIC ENGINEERING



Express Publishing

**Published by Express Publishing**

**Liberty House, Greenham Business Park, Newbury,  
Berkshire RG19 6HW, United Kingdom**

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**[www.expresspublishing.co.uk](http://www.expresspublishing.co.uk)**

© Express Publishing, 2016

Design and Illustration © Express Publishing, 2016

First published 2016

Made in EU

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ISBN 978-1-4715-5357-8

## Acknowledgements

### **Authors' Acknowledgements**

We would like to thank all the staff at Express Publishing who have contributed their skills to producing this book. Thanks for their support and patience are due in particular to: Alex Newton (Editor in Chief); Sean Todd (senior editor); Steve Miller (editorial assistant); Richard White (senior production controller); the Express design team; Sweetspot (recording producers). We would also like to thank those institutions and teachers who piloted the manuscript, and whose comments and feedback were invaluable in the production of the book.

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Book

1

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## Scope and Sequence

Unit	Topic	Reading context	Vocabulary	Function
1	The Role of Genetic Engineering	Article	agricultural, application, develop, genetic engineering, industrial, manipulate, medical, modify, pharmaceutical, research	Making a generalization
2	The Lab and Equipment 1	Equipment list	Erlenmeyer flask, eye wash station, filter funnel, fume hood, graduated cylinder, lab, microscope, pipette, volumetric flask, wash bottle	Asking permission
3	The Lab and Equipment 2	Passage	analytical balance, centrifuge, dry bath, electrophoresis chamber, hot plate, incubation oven, orbital shaker, pH meter, spectrophotometer, water bath	Estimating time
4	The Scientific Method	Abstract	conclusion, control group, experiment, experimental group, hypothesis, independent variable, observation, problem, result, testable	Describing poor results
5	Working with Numbers	Email	cubed, exponent, hundredths, leading zero, rounding error, scientific notation, significant figure, squared, tenths, thousandths	Identifying a problem
6	Analyzing Numbers and Quantities	Textbook passage	convert, decimal number, denominator, fraction, numerator, out of, percent, point, ratio, reduce	Making an estimate
7	Describing Change	Article	accelerate, contract, decrease, drop off, expand, fluctuate, increase, retard, spike, stabilize	Making comparisons
8	Measurements 1	Conversion chart	centimeter, fluid ounce, gram, imperial, inch, liter, metric, milliliter, ounce, quart	Making an apology
9	Measurements 2	Textbook entry	Avogadro's number, Celsius, cubic meter, Kelvin, kilogram, micrometer, micron, molar concentration, mole, SI unit	Asking for clarification
10	Accounting	Email	consumption, extensive quantity, final, generation, initial, input, intensive quantity, output, system, universal accounting equation	Asking about progress
11	Matter	Textbook passage	atom, atomic number, compound, electron, element, mass number, matter, molecule, neutron, proton	Identifying an error
12	Chemical Reactions	Textbook passage	balanced, chemical reaction, endothermic, exothermic, precipitate, product, reactant, solution, stoichiometry, yield	Correcting an error
13	Parts of a Cell 1	Encyclopedia entry	cell envelope, cell wall, cell, cytoplasm, flagella, nucleoid, plasma membrane, plasmid, prokaryotic, ribosomes	Asking about progress
14	Parts of a Cell 2	Poster	animal cell, chloroplast, ER, eukaryotic, Golgi apparatus, lysosomes, mitochondria, nucleolus, nucleus, plant cell	Checking for correctness
15	Genetic Material	Textbook entry	amino acid, central dogma, DNA, enzyme, heteropolymer, protein, reverse transcription, RNA, transcription, translation	Asking for clarification

# Table of Contents

<b>Unit 1 – The Role of Genetic Engineering</b> .....	4
<b>Unit 2 – The Lab and Equipment 1</b> .....	6
<b>Unit 3 – The Lab and Equipment 2</b> .....	8
<b>Unit 4 – The Scientific Method</b> .....	10
<b>Unit 5 – Working with Numbers</b> .....	12
<b>Unit 6 – Analyzing Numbers and Quantities</b> .....	14
<b>Unit 7 – Describing Change</b> .....	16
<b>Unit 8 – Measurements 1</b> .....	18
<b>Unit 9 – Measurements 2</b> .....	20
<b>Unit 10 – Accounting</b> .....	22
<b>Unit 11 – Matter</b> .....	24
<b>Unit 12 – Chemical Reactions</b> .....	26
<b>Unit 13 – Parts of a Cell 1</b> .....	28
<b>Unit 14 – Parts of a Cell 2</b> .....	30
<b>Unit 15 – Genetic Material</b> .....	32
<b>Glossary</b> .....	34

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**2**

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## Scope and Sequence

Unit	Topic	Reading context	Vocabulary	Function
1	Cell Division 1	Textbook excerpt	asexual reproduction, binary fission, cell division, clonal fragmentation, egg, gamete, haploid, meiosis, multiple fission, sexual reproduction, sperm, spore	Correcting yourself
2	Cell Division 2	Encyclopedia entry	anaphase, cell cycle, chromosome, cytokinesis, diploid, interphase, metaphase, mitosis, prophase, senescent, telomere, telophase	Narrowing information
3	Mendelian Inheritance	Article	allele, characteristic, dominant, F-, hereditary, heterozygous, homozygous, inherit, locus, phenotype, Punnett square, recessive, trait	Confirming a prediction
4	Nucleic Acids	Textbook excerpt	adenine, cytosine, double helix, double-stranded, guanine, messenger RNA, nucleic acid, nucleotide, polynucleotide, ribosomal RNA, thymine, transfer RNA, uracil	Asking for help
5	Gene Structure	Textbook excerpt	coding strand, gene, intron, exon, non-coding strand, non-template, promoter, strand, template, transcriptional	Asking for clarification
6	Isolating Nucleic Acids 1	Website	component, deproteinization, disrupt, expose, handle, isolate, purify, quantify, recover, separate, shear, starting material	Estimating time
7	Isolating Nucleic Acids 2	Employee manual	cell disruption, enzymatic degradation, detergent, lysis, phenol, phase, emulsion, partition, ethanol, precipitation, pellet, centrifugation	Confirming information
8	Labeling Nucleic Acids	Journal article	autoradiogram, DNase 1, dNTP, end labeling, Klenow fragment, nick translation, nucleic acid hybridization, polynucleotide kinase, primer extension, probe, radiolabeling, specific activity	Stating a preference
9	Gel Electrophoresis	Webpage	agarose, electric field, ethidium bromide, gel electrophoresis, gel, marker dye, matrix, negative charge, polyacrylamide, polyanionic, positive electrode, UV light, visualize	Asking for a reminder
10	Sequencing DNA	Textbook excerpt	base, chemical sequencing, cleave, ddNTP, denatured, dideoxy sequencing, enzymatic synthesis, fragment, Maxam-Gilbert sequencing, method, nested fragment, Sanger-Coulson sequencing, sequence	Describing similarities
11	DNA Modification	Article	blunt, cutting site, DNA ligase, endonucleases, exonucleases, incubate, nucleases, polymerase, protruding, recognition sequence, restriction enzyme, restriction-modification, ribonucleases	Asking for more information
12	Host Cells	Chart	gene cloning, host, bacteria, Gram-positive, Gram-negative, fungi, microbial, filamentous, protoplast, intact cell, organism, insect cell, mammalian cell, oocyte	Discussing about progress
13	Vectors: Plasmids	Email	conjugative, copy number, genomic library, multiple cloning site, non-conjugative, origin of replication, plasmid vector, polylinker, relaxed, selectable marker, stringent, vector	Describing confusion
14	Vectors: Bacteriophages	Website	adsorption, bacteriophage, capsid, insertion vector, lysis, M13, package, prophage, replacement vector, replicative form, temperate, virulent, $\lambda$	Making a comparison
15	Other Vectors	Journal article	BACs, cosmid, hybrid, phagemid, phasmid, size limitation, YACs, YCps, yeast, YEps, Ylps, YRps	Describing options

# Table of Contents

<b>Unit 1 – Cell Division 1</b> .....	4
<b>Unit 2 – Cell Division 2</b> .....	6
<b>Unit 3 – Mendelian Inheritance</b> .....	8
<b>Unit 4 – Nucleic Acids</b> .....	10
<b>Unit 5 – Gene Structure</b> .....	12
<b>Unit 6 – Isolating Nucleic Acids 1</b> .....	14
<b>Unit 7 – Isolating Nucleic Acids 2</b> .....	16
<b>Unit 8 – Labeling Nucleic Acids</b> .....	18
<b>Unit 9 – Gel Electrophoresis</b> .....	20
<b>Unit 10 – Sequencing DNA</b> .....	22
<b>Unit 11 – DNA Modification</b> .....	24
<b>Unit 12 – Host Cells</b> .....	26
<b>Unit 13 – Vectors: Plasmids</b> .....	28
<b>Unit 14 – Vectors: Bacteriophages</b> .....	30
<b>Unit 15 – Other Vectors</b> .....	32
<b>Glossary</b> .....	34



**CAREER  
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**3**

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## Scope and Sequence

Unit	Topic	Reading context	Vocabulary	Function
1	Delivering Genetic information	Textbook excerpt	biolistic, competent, concameter, electroporation, growth transformation, in vitro, macroprojectile, microinjection, microprojectile, packaging extract, propagation, transfection, transformant, transformation	Clarifying information
2	Cloning Methods	Course description	abundance class, adaptor, anneal, blunt-end ligation, cDNA, cohesive termini, homopolymer tailing, in vivo, ligation, linker molecule, mRNA, diversity, route, synthesis	Describing a process
3	PCR	Article	amplification, contaminant, IPCR, nested PCR, PCR, primer, RAPD-PCR, RT-PCR, sterile, thermal cyclers, thermostable, <i>Thermus aquaticus</i>	Making a suggestion
4	Gene Identification: Selection and Screening	Website	antibiotic, antibody, antigen, complementation, immunological, insertional inactivation, monoclonal, plaque, polyclonal, resistant, screening, select, selection, X-gal	Expressing familiarity
5	Gene identification: Analysis	Textbook excerpt	blotting apparatus, capillary action, confirm, dot-blotting, filter, HART, HRT, Northern blotting, restriction mapping, Southern blotting, structure, Western blotting, wick	Talking about differences
6	Gene Expression	Article	bioinformatics, delete, deletion analysis, DNA footprinting, DNase protection, gel retardation, gene expression, genome, progressively, S1 mapping, upstream	Describing a process
7	Genomes	Article	clone mapping, EST mapping, FISH, genetic mapping, genomics, linkage mapping, long-range restriction mapping, physical mapping, physical marker, radiation hybrid mapping, recombination frequency, STS mapping	Correcting an error
8	Biotechnology	Article	baculovirus, biotechnology, downstream processing, fusion protein, IGF-1, manufacture, native protein, polyhedra, polyhedrin, protease, rBST, reading frame, rennet, transfer vector	Stating an opinion
9	Forensic Analysis	Website	bloodstain, body fluid, DNA fingerprinting, DNA profiling, evidence, forensics, microsatellite, minisatellite, multi-locus probe, paternity test, sample, single-locus probe, STR, VNTR	Asking about progress
10	Medical Applications 1: Diagnosis	Article	aetiology, chromosomal abnormality, chromosome jumping, chromosome walking, congenital, cystic fibrosis, diagnosis, Down syndrome, false negative, gene mutation, monosomic, trisomic, viral infection	Asking for clarification
11	Medical Applications 2: Treatment	Abstract	aetiology, chromosomal abnormality, chromosome jumping, chromosome walking, congenital, cystic fibrosis, diagnosis, Down syndrome, false negative, gene mutation, monosomic, trisomic, viral infection	Asking for details
12	Transgenic Plants	Article	Bt plant, drought, EPSPS, glyphosate, GMO, herbicide, resistance, sterile, technology protection system, terminator technology, tolerance, transgenic	Discussing pros and cons
13	Transgenic Animals	Website	bioreactor, chimaeric organism, disease state, knockin, knockout, mosaic embryo, nuclear transfer, organ, pronuclei, therapeutic protein, xenotransplantation, zygote	Describing experience
14	Cloning	Textbook chapter	blastocyst, culture, embryo splitting, enucleate, epigenesis, fuse, G <sub>0</sub> phase, implant, irreversibly differentiated, nuclear totipotency, cloning, pluripotent, quiescent	Describing a process
15	Ethical Concerns	Advertisement	blastocyst, culture, embryo splitting, enucleate, epigenesis, fuse, G <sub>0</sub> phase, implant, irreversibly differentiated, nuclear totipotency, organismal cloning, pluripotent, quiescent	Disagreeing with an opinion

# Table of Contents

<b>Unit 1 – Delivering Genetic Information</b> .....	4
<b>Unit 2 – Cloning Methods</b> .....	6
<b>Unit 3 – PCR</b> .....	8
<b>Unit 4 – Gene Identification: Selection and Screening</b> .....	10
<b>Unit 5 – Gene Identification: Analysis</b> .....	12
<b>Unit 6 – Gene Expression</b> .....	14
<b>Unit 7 – Genomes</b> .....	16
<b>Unit 8 – Biotechnology</b> .....	18
<b>Unit 9 – Forensic Analysis</b> .....	20
<b>Unit 10 – Medical Applications 1: Diagnosis</b> .....	22
<b>Unit 11 – Medical Applications 2: Treatment</b> .....	24
<b>Unit 12 – Transgenic Plants</b> .....	26
<b>Unit 13 – Transgenic Animals</b> .....	28
<b>Unit 14 – Organismal Cloning</b> .....	30
<b>Unit 15 – Ethical Concerns</b> .....	32
<b>Glossary</b> .....	34

genetic engineering

medical

## Genetic Engineering: What's It For?

All living things have genes. And now scientists can **modify** them. **Genetic engineering** allows scientists to **manipulate** DNA. This field has many **applications**.

Genetic engineering has many **medical** uses. Genetic engineers are **developing** treatments for serious diseases. Often, this occurs with genetically-modified (GM) mice and pigs. These animals have similar genes to humans. So diseases affect them in similar ways.

Scientists are also **researching** GM bacteria. This has **industrial** applications. The bacteria can fuel machines. And it can clean up toxic chemicals, such as oil.

The **agricultural** industry uses genetic engineering, too. GM crops resist disease, drought, and even insect damage. Farmers can raise **pharmaceutical** crops, too. These modified plants produce important proteins and antibiotics.

industrial

agricultural

research

pharmaceutical

## Get ready!

1 Before you read the passage, talk about these questions.

- 1 What are some medical uses for genetic engineering?
- 2 What are some other uses for genetic engineering?

## Reading

2 Read the article. Then, complete the table.

GM Organism	Use
Mice and pigs	1 _____
Bacteria	2 _____
Crops	3 _____

## Vocabulary

3 Match the words (1-6) with the definitions (A-F).

- |              |                     |
|--------------|---------------------|
| 1 __ modify  | 4 __ industrial     |
| 2 __ develop | 5 __ agricultural   |
| 3 __ medical | 6 __ pharmaceutical |

- A related to the treatment of illnesses and injuries  
 B related to manufacturing activities  
 C to create something or a way to do something  
 D related to the process of creating drugs for medical conditions  
 E related to the process of farming  
 F to alter something

**4 Write a word or phrase that is similar in meaning to the underlined part.**

- The science of changing an organism's genes is improving life for everyone.  
\_ \_ n \_ t \_ \_ \_ \_ g \_ \_ e \_ r \_ \_ \_
- Scientists change plants' genes so they are disease-resistant.  
m \_ \_ \_ \_ u \_ \_ \_ e
- There are many uses for genetic engineering in the field of medicine.  
\_ \_ \_ l \_ \_ a \_ \_ o \_ \_ s
- People are looking into ways to cure different types of cancer.  
\_ e \_ e \_ \_ \_ h \_ \_ \_

**5 Listen and read the article again. Why do genetic engineers test medical treatments on some animals?**

**Listening**

**6 Listen to a conversation between a job applicant and an interviewer. Mark the following statements as true (T) or false (F).**

- The woman's last employer did industrial genetic engineering.
- The woman has experience with pharmaceutical crops.
- The man's company is developing a plant that generates antibiotics.

**7 Listen again and complete the conversation.**

**Interviewer:** So you have experience with **1** \_\_\_\_\_ ?

**Applicant:** Yes, I've worked in the field for **2** \_\_\_\_\_ .

**Interviewer:** Okay. What kind of work did you last **3** \_\_\_\_\_ do?

**Applicant:** Mostly **4** \_\_\_\_\_ engineering.

**Interviewer:** Really? How were you **5** \_\_\_\_\_ ?

**Applicant:** I primarily researched **6** \_\_\_\_\_ . Our plants generated antibiotics.

**Speaking**

**8 With a partner, act out the roles below based on Task 7. Then, switch roles.**

**USE LANGUAGE SUCH AS:**

*What kind of work ... ?*

*Really?*

*I primarily researched ...*

**Student A:** You are an interviewer. Talk to Student B about:

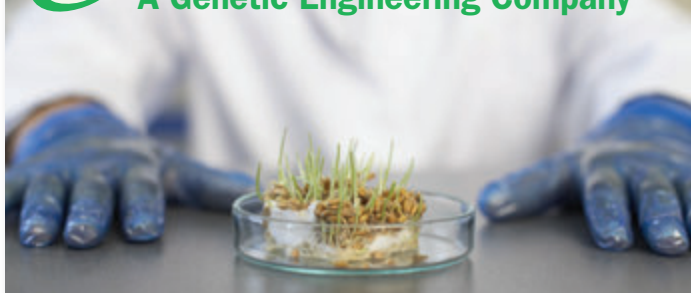
- how much experience he or she has
- what kind of work his or her last employer did
- how he or she was involved in that work

**Student B:** You are a job applicant. Talk to Student A about your experience in genetic engineering.

**Writing**

**9 Use the conversation from Task 8 to fill out the website.**

**Genetic Works**  
A Genetic Engineering Company



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**About Us:**

At Genetic Works, we use genetic engineering for many applications. We primarily do \_\_\_\_\_ .  
 Within this field, we are researching \_\_\_\_\_ .  
 \_\_\_\_\_ . We are developing \_\_\_\_\_ .  
 We also \_\_\_\_\_ .

# Glossary

**accelerate** [V-I-U7] To **accelerate** is to go faster.

**agricultural** [ADJ-U1] If something is **agricultural**, it is related to the process of farming.

**amino acid** [N-COUNT-U15] An **amino acid** is a substance that groups with other amino acids to form proteins.

**analytical balance** [N-COUNT-U3] An **analytical balance** is a device that measures mass extremely accurately.

**animal cell** [N-COUNT-U14] An **animal cell** is a type of eukaryotic cell that makes up most tissues in animals.

**application** [N-COUNT-U1] An **application** is a use or purpose for something.

**atom** [N-COUNT-U11] An **atom** is the smallest piece of matter that can exist by itself.

**atomic number** [N-COUNT-U11] An **atomic number** is a measure of the number of protons in an atom, and is used to identify atoms from different elements.

**Avogadro's number** [N-UNCOUNT-U9] **Avogadro's number** is the number of particles present in a single mole of a substance. It is a constant equal to  $6.02 \times 10^{23}$ .

**balanced** [N-ADJ-U12] If something is **balanced**, it is in a state of even distribution or equilibrium.

**cell** [N-COUNT-U13] A **cell** is the smallest part of a living body that can function independently.

**cell envelope** [N-COUNT-U13] A **cell envelope** is part of a cell containing the cell wall and plasma membrane.

**cell wall** [N-COUNT-U13] A **cell wall** is a hard but flexible substance that surrounds some cells and give them a rigid structure.

**Celsius** [ADJ-U9] If a measurement is **Celsius**, it uses the temperature scale in which water boils at 100 degrees and freezes at 0 degrees.

**centimeter** [N-COUNT-U8] A **centimeter** is a metric unit of length equal to 1/100 meter or 0.39 inches.

**central dogma** [N-UNCOUNT-U15] The **central dogma** is a concept in molecular biology that states that genetic information almost always moves from DNA to RNA and then to proteins and not in reverse.

**centrifuge** [N-COUNT-U3] A **centrifuge** is a device that spins substances very fast in order to separate heavy particles from lighter ones.

**chemical reaction** [N-COUNT-U12] A **chemical reaction** is a process that changes the molecular structure of a substance.

**chloroplast** [N-COUNT-U14] A **chloroplast** is an organelle found in plant cells that uses photosynthesis to generate energy.

**compound** [N-COUNT-U11] A **compound** is combination of two or more elements.

**conclusion** [N-COUNT-U4] A **conclusion** is a decision or statement made after carefully considering available information or results.

**consumption** [N-UNCOUNT-U10] **Consumption** is the act of using, or consuming, something.

**contract** [V-I-U7] To **contract** is to become smaller in size.

**control group** [N-COUNT-U4] A **control group** is a group that is not affected by any variables in an experiment.

**convert** [V-T-U6] To **convert** something is to change it into a different form or system of measurement.

**cubed** [ADJ-U5] If a number is **cubed**, it is multiplied by itself twice. For instance, 2 cubed ( $2^3$ ) is 8 because  $2 \times 2 \times 2 = 8$ .

**cubic meter** [N-COUNT-U9] A **cubic meter** is a unit of volume equal to one meter in each dimension.

**cytoplasm** [N-UNCOUNT-U13] **Cytoplasm** is the substance located within a cell's membrane that holds all of the cell's organelles.

**decimal number** [N-COUNT-U6] A **decimal number** is a number that contains a decimal point.

**decrease** [V-I-U7] To **decrease** is to become smaller in number, size, or amount.

CAREER  
PATHS

# GENETIC ENGINEERING



**Career Paths: Genetic Engineering** is a new educational resource for genetic engineering professionals who want to improve their English communication in a work environment. Incorporating career-specific vocabulary and contexts, each unit offers step-by-step instruction that immerses students in the four key language components: reading, listening, speaking, and writing. **Career Paths: Genetic Engineering** addresses topics including the scientific method, DNA, types of experiments, medical applications, and impact on agriculture. The series is organized into three levels of difficulty and offers a minimum of 400 vocabulary terms and phrases. Every unit includes a test of reading comprehension, vocabulary, and listening skills, and leads students through written and oral production.

**Included Features:**

- A variety of realistic reading passages
- Career-specific dialogues
- 45 reading and listening comprehension checks
- Over 400 vocabulary terms and phrases
- Guided speaking and writing exercises
- Complete glossary of terms and phrases

The **Teacher's Guide** contains detailed lesson plans, a full answer key and audio scripts.

The **audio CDs** contain all recorded material.



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ISBN 978-1-4715-5357-8



9 781471 553578