

Activity 2.2.3

An Inheritance Story

Where it came from, and what the odds are next time. Alleles, pedigrees, Punnett squares and the difference between a risk number and a prediction. Then the hardest conversation in this unit.

DATE (PERIOD 1-2)	OTHER SECTIONS	PORTAL DAY
Friday 2026-10-30	use this sheet on the day your own portal page links it	Genetic testing ethics debate
LESSON	TURN IN	
Lesson 2.2 Decoding a Diagnosis	Exit ticket	

Where this sits. Single day. Portal calendar label for today: Genetic testing ethics debate.

01 Why today matters

The parents want to know how their child got this, whether another child would have it, and eventually whether he can have children of his own.

Every one of those is a different question with a different answer, and today you build the two tools that answer them.

02 What you already know

- You know a gene carries instructions for a protein and that a change to the sequence can stop that protein working.
- You know body cells hold 46 chromosomes in pairs, one member of each pair from each biological parent. Today those two facts combine into an inheritance pattern.

WHAT THIS SHEET WILL NOT TELL YOU

- No genotype, no answer about where this patient's condition came from, and no chance figure for this family appears on this sheet. You build those from the pedigree and the squares.

03 Vocabulary

TERM	WHAT IT MEANS, PLAINLY
Genotype	The versions of a gene a person actually carries. Written as two letters, because you have two copies.
Phenotype	What you can observe. The trait, or the presence or absence of symptoms.
Allele	One version of a gene. Different alleles are why people differ in eye color, skin tone and much else.
Dominant allele	An allele whose effect appears even when only one copy is present. Written as a capital letter. Dominant does not mean common, better or stronger in any everyday sense.
Recessive allele	An allele whose effect appears only when both copies are that version. Written lower case.
Homozygous	Both copies are the same allele.

Heterozygous	The two copies are different alleles.
Carrier	Most often, someone heterozygous for a recessive condition: they carry the allele and do not show the trait. The word is also used for a woman with one changed X for an X-linked condition, for a person with a balanced chromosome rearrangement, and for dominant variants that raise risk without guaranteeing disease, such as BRCA1 and BRCA2.
Autosome	Any of chromosome pairs 1 to 22. Not a sex chromosome.
Sex chromosomes	The pair that is X and X, or X and Y.
Autosomal dominant	One changed copy on a non-sex chromosome is enough to produce symptoms.
Autosomal recessive	Two changed copies are needed. One changed copy makes a carrier.
Gamete	An egg or a sperm. Carries 23 chromosomes, one from each pair.
Spontaneous mutation	A change that arose newly in the egg or sperm a person came from, rather than being passed down. Neither parent carries it.
Pedigree	A family diagram showing who has a trait across generations. Squares are male, circles female, filled means affected, half filled means carrier, a diagonal line means deceased.
Generation numbering	Rows get Roman numerals, individuals within a row get Arabic numerals, firstborn on the left. So II-3 is the third person in the second generation.
Punnett square	A grid that lists one parent's alleles across the top and the other's down the side, then fills in every combination an offspring could get.
Probability	The chance of an outcome for one event. Each pregnancy is its own event and the previous ones do not change it.
Genetic counselor	A professional trained to explain inheritance and risk to families and to help them decide what to do with the information.

04 How to do the work

Tools first, then the family conversation. The conversation is the assessment, and it is only as good as the diagrams underneath it.

- 1 Write the difference between genotype and phenotype in one sentence each, then give an everyday example where two people share a phenotype and have different genotypes.
- 2 Learn the letter convention this activity uses: capital for the dominant allele, lower case for the recessive one, always the same letter. Then write out the three possible genotypes and, for each, whether that person shows the trait.
- 3 Answer this in writing before you go further: in a condition where one changed copy always causes symptoms, can anyone carry it silently? Then name one situation from the vocabulary where the word carrier is still used.
- 4 Learn the pedigree symbols. Copy them into your notebook with labels. Then copy the example pedigree and label it fully with Roman and Arabic numerals.
- 5 Describe the example pedigree in prose. Name the individuals who show the trait by their numbers, and state which generations they sit in.
- 6 Work through the two pattern examples. For each, write the rule you used to decide the pattern. The two rules to have in your head: for a dominant trait, every affected person has at least one affected parent; for a recessive trait, two unaffected parents can have an affected child.
- 7 Read about how often a condition arises spontaneously rather than being inherited, then answer the parents' first question with reasoning that uses the pedigree, not a guess.

- 8 Build the family pedigree for your patient. Include the parents and the patient with correct symbols and full numbering, then add a hypothetical younger brother and a hypothetical younger sister, shaded according to what you can and cannot know.
- 9 Learn the Punnett square by working the freckles example in the activity all the way through, including converting the four boxes into a genotype percentage and a phenotype percentage. Those are two different answers.
- 10 Practice on the three eye color scenarios. For each, give the percentage chance of each genotype and each phenotype. Compare with a partner and reconcile any differences by rebuilding the square, not by discussing it.
- 11 Practice on the family pedigrees for a recessive condition, giving both the chance of being affected and the chance of being a carrier. These are different numbers and students routinely give one when asked for the other.
- 12 Build the two Punnett squares for your patient's future children: one where the partner also carries the condition, one where they do not. State the percentage for each.
- 13 Write the script. What you will actually say to the parents, using the pedigree and the squares as visual aids, covering how their child came to have this, the chance for a future child of theirs, and the chance for their child's own children one day. Read it aloud to a partner, take their feedback, and revise it.

THE DEBATE YOU ARE TAKING A POSITION ON TODAY

- Genetic testing can tell people what they may pass on before they decide whether to have children. The technology exists, it is affordable, and using it is a choice.
- Should people screen their genes before deciding to have children? And should a doctor raise it if the family has not asked?
- You have to argue this today, and both directions have real force. Screening gives people information to plan with. It also creates a number about a future person who cannot consent, invites judgment about who should exist, and delivers a risk figure to people with no training to weigh it.
- Your exit ticket is two sentences: name the strongest argument you heard against your position, and say whether it changed your claim.

05 Where students get stuck

- Thinking dominant means common or strong. It describes one thing only: whether one copy is enough to show the effect. Plenty of dominant conditions are rare, and plenty of recessive alleles are widespread.
- Calling someone a silent carrier of a condition where one copy always produces symptoms. If one copy is always enough, nobody carries it silently. Carrier is used in several senses (recessive, X-linked, balanced rearrangements, dominant risk variants such as BRCA1 and BRCA2), so check which one a sentence means.
- Reading a Punnett square as a guarantee across four children. Twenty-five percent means one in four for each pregnancy, independently. Four children can all be affected or none can. Every pregnancy starts the odds over.
- Giving the affected percentage when asked for the carrier percentage. For a recessive condition with two heterozygous parents these are different numbers from the same square. Read the question twice and label which boxes you counted.
- Assuming a condition with no family history was not genetic. A change can arise newly in the egg or sperm a person came from. Then neither parent carries it, the pedigree shows nothing above, and the condition is still genetic and still heritable onward. Missing this is the most common wrong answer in this activity.
- Writing a script full of the words on this page. Genotype, heterozygous and autosomal are your words, not the family's. Write the science accurately in your notebook and then say it to them in ordinary language. The rewrite is the skill being marked.

06 What you turn in

EXIT TICKET

One exit ticket, submitted as one PDF to the Schoology item named on your portal page: two sentences on the screening debate in the box above, naming the strongest argument you heard against your position and saying whether it changed your claim. Your pedigree, both Punnett squares and your family script stay in your notebook; you use them again on the pedigree and risk day.

07 Check yourself

- ☐ Two parents show no signs of a condition and their child does. Which inheritance pattern does that fit, and what is the other explanation that fits equally well? (Vocabulary, autosomal recessive and spontaneous mutation)
- ☐ A Punnett square gives a 50 percent chance. A family already has two affected children. What is the chance for the third, and why? (Vocabulary, probability, and Where students get stuck)
- ☐ Explain in one sentence why nobody can silently carry a condition in which one copy always causes symptoms, then name one kind of carrier who may never show a condition. (Vocabulary, carrier and dominant allele)