

## HS-LS3-3

Students who demonstrate understanding can:

**HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.** [Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] [Assessment Boundary: Assessment does not include Hardy-Weinberg calculations.]

The performance expectation above was developed using the following elements from *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><b>Analyzing and Interpreting Data</b> Analyzing data in 9-12 builds on K-8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.</p> <ul style="list-style-type: none"> <li>Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.</li> </ul>	<p><b>LS3.B: Variation of Traits</b></p> <ul style="list-style-type: none"> <li>Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus, the variation and distribution of traits observed depends on both genetic and environmental factors.</li> </ul>	<p><b>Scale, Proportion, and Quantity</b> Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth).</p> <p>-----</p> <p><b>Connections to Nature of Science</b></p> <p><b>Science is a Human Endeavor</b></p> <ul style="list-style-type: none"> <li>Technological advances have influenced the progress of science and science has influenced advances in technology.</li> <li>Science and engineering are influenced by society and society is influenced by science and engineering.</li> </ul>

### Observable features of the student performance by the end of the course:

1	Organizing data	
	a	Students organize the given data by the frequency, distribution, and variation of expressed traits in the population.
2	Identifying relationships	
	a	Students perform and use appropriate statistical analyses of data, including probability measures, to determine the relationship between a trait's occurrence within a population and environmental factors.
3	Interpreting data	
	a	Students analyze and interpret data to explain the distribution of expressed traits, including:
		i. Recognition and use of patterns in the statistical analysis to predict changes in trait distribution within a population if environmental variables change; and
		ii. Description* of the expression of a chosen trait and its variations as causative or correlational to some environmental factor based on reliable evidence.