The Trait Continuum

Genes & Environment

Abstract

Students sort examples of traits along a continuum based on how much they are shaped by genes vs. environmental factors. Most examples are influenced by both..

Learning Objective

• Most traits are influenced by both genes and the environment.

Estimated time

• 20 minutes

Materials

• Copies

Instructions

1. Print and cut out Trait cards to create 8-card sets. Make enough copies to give one set to each group or pair of students.

   Note: works best when printed in color.

2. Distribute sets of cards.

3. Instruct students to group their cards across a continuum. At one end is "genes," and at the other is "environment." Encourage students to read the cards, not just draw upon what they already know.

4. Have students share what they did, either through a whole-group discussion or by having each group put their cards on display.

Discuss:

• Do you think the nature vs. nurture question is useful to debate? How would you re-frame this debate?

• Can you think of any other traits that are most strongly influenced by the environment? (Examples: spoken language, musical taste, disease caused by an environmental factor–for instance skin cancer from sun exposure, cancer from smoking)

- For traits with a strong environmental influence, how easy is it to change a trait once you have it?

- Note: A common misconception is that if a trait is environmental, then it can be controlled. Many examples counter this. For instance, after a certain age, most people cannot learn a new language and speak it accent-free. Similarly, growth problems from malnutrition cannot be corrected once growth has stopped, and we can't un-do exposure to environmental toxins.

- With enough creative thinking, it's possible to come up with genetic and environmental factors that could possibly influence just about any trait that we can come up with. Encourage your students to play with this idea.

Notes

Students may come to different conclusions about some of the in-between examples, and that's ok. We have intentionally chosen examples that are muddy and challenging. What's more important is that the examples on the extremes (traditions and nutrient deficiencies on the environment end, and Huntington Disease and hair color on the genes end) are arranged correctly, that students have fruitful discussions, and that they can explain their choices.

References

Fayzullina, S., Smith, R. P., Furlotte, N., Hu, Y., Hinds, D., & Tung, J. Y. (2015). White Paper 23-08 *Genetic Associations with Traits in 23andMe Customers.*

Gregersen, P. K., Kowalsky, E., Lee, A., Baron-Cohen, S., Fisher, S. E., Asher, J. E., ... & Li, W. (2013). Absolute pitch exhibits phenotypic and genetic overlap with synesthesia. *Human molecular genetics, 22*(10), 2097-2104.

Min, J., Chiu, D. T., & Wang, Y. (2013). Variation in the heritability of body mass index based on diverse twin studies: a systematic review. *Obesity reviews, 14*(11), 871-882.

Stunkard, A. J., Harris, J. R., Pedersen, N. L., & McClearn, G. E. (1990). The body-mass index of twins who have been reared apart. *New England Journal of Medicine, 322*(21), 1483-1487.

Theusch, E., Basu, A., & Gitschier, J. (2009). Genome-wide study of families with absolute pitch reveals linkage to 8q24. 21 and locus heterogeneity. *The American Journal of Human Genetics, 85*(1), 112-119.