Supplement 3: Glossary of Terms for Teachers

Expanded Definitions of Challenging Terms to Help you Reduce MTisconceptions (adapted from Broder et al. 2018)

**Evolution by natural selection**: genetic change in a population over time due to natural selection. More specifically, it is a change in the allele frequencies among individuals in a population over generations. Evolution may also occur without selection through random processes like drift, but that is beyond the scope of this activity. That is the reason we clarify that this definition is “evolution by natural selection” rather than simply “evolution”.

Evolution by natural selection requires Variation, Inheritance, Selection, and Time (VIST):

**Variation**: organisms within a population that differ

**Inheritance**: a portion of this variation must be heritable--it can be passed on to the next generation through reproduction. Offspring inherit traits from their parents via DNA.

**Selection**: but not all individuals in a population survive and reproduce to pass on their traits, and this is not random. Certain traits make animals more or less likely to survive and reproduce; selection is the force acting on those traits.

**Natural selection**: the selective force that shapes which individuals survive and pass on their traits in each generation. It includes things like the environment, competition, predators, but also sexual selection (mate choice).

**Time**: Evolution cannot be measured within a generation, only over generations. It is the change in allele frequencies at the population level over generations. That is why we include multiple generations in our game. However, remember that selection acts on individuals within a generation.

**Adaptation**: a trait that helps an organism survive and reproduce in a given environment. Adaptations depend on the environment since a trait may not offer an advantage if the environment changes. The word adaptation refers to a trait that has been under selection in a population over generations in a given environment. An individual cannot adapt within its lifetime since evolution is measured over generations. So if a bear puts on fat in the winter, it is acclimating to its environment, not adapting.

**Mutation**: this is a random change in an organism's DNA. Mutations often do not cause a measurable change in an organism's’ traits, and mutations are only passed on if they affect reproductive cells (somatic mutations occur in non-reproductive cells and are not inherited). Mutations that cause changes in an organism may be positive, negative, or neutral. Mutation is critical because it creates variation, which is required for evolution.

**Ecosystems dynamics**: the study of how environments change over time. This is a key part of our game since selection depends on the environment, and environments are constantly changing.

Reference: Broder ED**,** Angeloni LM, Simmons S, Warren S, Knudson KD, Ghalambor CK (2018) Authentic science with live organisms can improve evolution education. *The American Biology Teacher.* 80(2), 116-123.