Playing god with evolution

Darwin's theory of natural selection describes how competition between individuals leads to organisms becoming adapted to their environments — giving the appearance of design, without a designer. Four recent board games have turned different aspects of natural selection into a game. But are they fun? And could they even be used to teach the science?

I tested the four games with a collection of scientists and non-scientists, adults and children. The lightest and most whimsical is *Gods Love Dinosaurs* (Pandasaurus Games; 2–5 players; 45–60 min; age 8+), where the title provides a good description of the game (Fig. 1). Each player is a god and, to win the game, you just need to get the most dinosaurs. Each dinosaur is a small wooden *Tyrannosaurus rex* and, to get more, you need to rear predators for them to eat — wooden tigers and eagles (some liberties have been taken). To get more tigers and eagles, you need to rear herbivores for them to eat — these are frogs, rats and rabbits. And you need tiles of the right habitat to rear those herbivores. But building up this hierarchical food chain isn't as easy as you might think. If your tigers eat up all the herbivores, then when the tigers next need to feed, they will instead starve and die. Ecosystem collapse is a real possibility and if you are not careful you can end up with a barren board, while everyone else's is thriving. And to make matters tougher, your opponents will be trying to interfere with your plans, triggering feeding events that benefit them and harm you. It isn't easy being a dinosaur-obsessed god, but it is amusing. If you wanted to teach about food chains and the problem of overexploitation, then this game could be a great start.

Genotype (Genius Games; 1–5 players; 47–75 min; age 14+) has turned Mendelian genetics into a game. In this game, players are monks conducting experiments to try and understand genetic inheritance. That might sound crazy, but it really does work. You gain points by collecting different pea genotypes, and how best to do that is an efficiency puzzle. You need to plan what pea genotypes to search for, manipulate the parental plants, hire assistants, use tools and set research goals! Good play requires you to adjust your strategy depending upon how the game is progressing, but also gives the opportunity to mess with other players — for example, by choosing parental plants that make it harder or impossible to get the genotypes that other players require.

Fig. 1 | *Gods Love Dinosaurs*. Photograph by Wouter Debisschop (Tabletopping).

Genius Games have done an amazing job of representing the science, and *Genotype* could easily be a teaching aid as well as a game. It even includes a booklet that goes into the science, and how the mechanics of the game were designed to capture the science.

In *Oceans* (North Star Games; 2–4 players; 60–90 min; age 12+), players compete to evolve the most successful marine species. You might start by producing a filter feeder that feeds and grows efficiently, and a symbiont that benefits from that filter feeder. But then one of your opponents evolves an apex predator that eats your species. And to really rub it in, one of the other players evolves a shark cleaner that benefits every time the apex predator feeds upon your species. At this stage, maybe your best option is to evolve to prevent predation, by producing ink or becoming transparent, so that your species can survive and the predator population crashes. This game captures the dynamic struggle of natural selection, in which the best strategy will change depending upon what everyone else is doing. Different plays of the game go down different evolutionary routes. The game has beautiful art, and as it progresses, opportunities for a huge variety of adaptations are opened up — including defensive spines, giant rows of teeth and coprophagia.

The most complex of the games is *Dominant Species: Marine* (GMT Games; 2–4 players; 1–3 h; age 14+). This game recreates the fight for marine dominance at the time of the dinosaurs. Each player takes the role of an aquatic group of animals: reptiles, fish, cephalopods or crustaceans. Your group will need to thrive as well as possible in different environments, and compete with the other groups. There is an impressive range of options for 'moves' that you can take, which represent different aspects of evolution and behaviour, including adapting to a new food source, migrating or eliminating competing species. Each player can choose a special power (trait) for their animal group, and evolutionary events occur to mix things up, so every game will be different. This is a gripping game, but it is not for the faint-hearted. It is a long brutal battle, where your plans will frequently be frustrated by the actions of other players. But if you can find fellow players that like this game, then it offers huge rewards. As you become more experienced, you will have tougher and tighter struggles. Just make sure that the group can all cope with direct conflict, where doing better usually means making things worse for someone else.

Oceans and *Dominant Species: Marine* each capture different aspects of natural selection, such as trade-offs, evolutionary

arms races and convergent evolution. But at the same time, they are games rather than simulations, and there are some important things about natural selection that they do not include. This provides a great basis for discussions or essays, especially as a student must understand natural selection really well to be able to explain what a game is missing or gets wrong.

Overall, these four games each have something very different to offer, and so which is 'best' will depend upon what you want. *Gods Love Dinosaurs* is quick and fun, and will leave you laughing at your own ecosystem collapse. *Genotype* has done the incredible job of turning Mendelian genetics into a challenging and entertaining puzzle. It would especially appeal to fans of population genetics, or anyone who has always wanted to be a monk. *Oceans* provides an exciting sea-based struggle for survival, where each player needs to closely follow how the others are evolving their species. With thoughtful eye candy, and lots of interactions between the players. *Dominant Species: Marine* is the most interactive and mean, providing a tense fight for evolutionary dominance until an asteroid arrives and wipes almost everything out. ❐

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Published online: 30 March 2022
https://doi.org/10.1038/s41559-022-01736-9